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THE EFFECT OF X-RAYS ON THE VITAMIN NEEDS OF THE ORGANISM AND CANCER[1]

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IN a previous paper (1) before the International Congress of Radiology we have given evidence to show that one of the immediate effects of X-rays on the organism is to protect the animal against a Vitamin B deficiency. We have further shown that it is this same effect which is probably important in inducing as well as destroying the cancerous tissue. We did not find these facts through an accidental study of the effect of X-rays on animals fed on a ration deficient in Vitamin B, but through an earlier analysis of the growth reaction of cells.

In these earlier studies (2) (3) (4), carried on by one of us (Burrows), it was found that body cells cannot grow in a tissue culture where simple synthetic media or blood plasma is used, except when they are crowded into a small stagnant mass which is well supplied with oxygen. This growth can be stopped by separating the cells, by increasing the amount of medium relatively about each cell, or by washing the cells with a stream of serum.

It was further shown that when the amount of medium is greatly increased and the cells completely separated by a wide interval, they show no activity whatever: they come to a state of complete rest insofar as cell division is concerned. Nevertheless, these cells are not dead: they become active again when crowded with other cells.

When embryonal or cancer cells are not separated to the extent necessary for inactivity, growth ceases but the cells show changes peculiar to their differentiation in the body.

Function maintains in these same cells, as seen by a study of muscle cells when one end of the cell is placed in contact with a dense mass of cells or fluid escaping from such a mass and the other end is placed in contact with an open part of the medium into which products of the cell's metabolism may escape.

For these studies of function, heart muscle, smooth muscle and striated muscle cells of embryos were used. When any of these cells are crowded in a drop of medium, they revert to simple mesenchyme or sarcoma-like cells, grow and divide by mitoses, and show no evidence of differentiation. When few are placed in the clot they differentiate into cells resembling in every way the fibroblast of the adult. Only when they become stretched between the fragment or surface film of material coming from the fragment, and a clean part of the clot which has separated from the fragment, do rhythmical

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contractions intervene. If these same cells are removed from this location into the film of materials coming from the fragment, they immediately assume the shape and characteristics of simple growing cells, grow and divide by mitoses.

Under these conditions of polarity it was interesting to note, further, that the type of function in each of these types of muscle cells is not the same. The heart muscle cells and striated muscle cells had a rapid, snappy rhythm like the heart in the body. The contractions of the smooth muscle cells, on the other hand, were slow and prolonged. Other cells polarized in the same way showed no contractions whatever.

In the light of these factors it became evident, therefore, that growth, differentiation and function, as they are seen in the organism, are not the normal sequence of change peculiar to the cells. They are merely reactions of the cells to a changing organization of the whole, or much more general formative forces acting in the organism. The active growth of the cells in early life is due to their being crowded into a stagnant mass. The later slowing of their growth, their differentiation and function are the result of the development of the vascular system and the removal of the stagnation necessary for their growth. In the study of function in muscle cells of various types it was noted that while this function is dependent on a specific polarization, or certain differences in the environment about one end of the cell from that of the other, the type of function is related to the cell so polarized. It became evident, therefore, that function in general may be the result of the same polarization. In proof of this deduction it was found that the functioning nerve fiber is stretched between the dense brain tissue and an end organ. The functioning gland cells are stretched between a stagnant duct and a rich vascular supply without.

The determining factor in the normal life of the organism, as seen from these last observations, is the vascular system. The stopping of the early growth of the cells, their differentiation and function are to be wholly related to the development of this system. There is no evidence from any of these studies that the cells suffered any irreversible changes in their differentiation and function. Adult cells cut from their circulation in the body and placed with other cells in a stagnant drop of medium in the culture revert under proper conditions to actively growing cells. Sarcoma cells scattered in a drop of plasma differentiate into typical adult fibroblasts.

Cancer, as we see it, therefore, is probably nothing more than the result of a local crowding of cells into a mass and a general reduction in the circulation in this mass. It is only the result of the establishment of the stagnation necessary for an active independent growth of the cells.

In proof of this conception it is known that cancer is a densely cellular tissue having a poor vascular supply. We have found that bacteria capable of producing cancer, and coal tar, act only to build such an organization. The cancerous organization, once induced, proceeds as a growing system independent of these causative agents. One of us (Jorstad) has shown that drops of coal tar act to produce the cancerous organization in that they attract the cells from the surrounding tissue away from their intercellular substances and blood vessels and crowd them about their peripheries. If a sufficient number of cells are so crowded together, growth intervenes. The coal tar attracts the cells by dissolving a lipoid substance of the cells. This lipoid substance has been called the *ergusia*. When a relatively large amount of coal tar acts on relatively few cells, the cells are destroyed by the complete removal of the ergusia from them. When larger numbers of cells are

affected by relatively smaller amounts of tar, they later recuperate and grow actively because the tar acts only until it becomes saturated with the ergusia.

Bacteria act in another manner to produce the same result. When non-toxic but actively growing bacteria, such as the *Bacillus tumefaciens,* are introduced between the blood vessels, they stimulate the cells to proliferate without the formation of blood vessels and intercellular material. A dense mass of cells is thus developed. Animal parasites act in the same capacity.

In other papers one of us (Burrows) has shown that such a mass, once developed, continues to grow and reproduce itself in that it destroys the normal tissues and blood vessels about it (4).

It is well known that X-rays and radium may induce cancer, as well as destroy it. How these rays act to produce this disease is a question which interested us next in our solution. Having established the relation of oxygen, stagnation and cell crowding to growth, it has also been of interest to one of us (Burrows) to look into the chemical significance of these relations. These latter studies have shown that these factors of oxygen, stagnation and cell crowding are important, because the growth of the cell depends on a certain high concentration of a substance or substances formed in proportion to the oxygen absorbed by the cell. This substance or substances has been called the *archusia* (S). The cells cannot retain this substance. It is soluble in plasma, in salt solution and the circulating fluids of the body. It can be readily extracted from any actively growing tissues and its properties tested on isolated cells. By these studies it was possible to show that it is important not only for the growth, but for all other activity of the cells. This substance acts to produce changes in the cells according to its concentration. In low concentrations (S^1) it has no effect. In medium concentrations (S^2) it causes the cells to migrate into a protein medium and towards larger droplets of fat. Small particles of proteins and small fat droplets are drawn into the cell under the influence of these conditions. These are stored, but not digested.

It is in this concentration of the archusia that differentiation takes place. The connective tissue cells do not grow, but they lay down intercellular substances. When an S^2 concentration of the archusia is localized at one end of the cell and continuously removed from the other end, they function.

Only in high concentrations (S^3) are the proteins and fats digested by the cells. In these concentrations growth and division maintain. In still higher concentrations, (S^4), the cell itself is digested.

The various environmental factors regulating growth, differentiation, and function, noted above, are important, therefore, only in terms of these latter facts, as they determine the concentration and localization of the archusia about the cells. In applying these latter facts to the organism and cancer it was found that while extracts of cancer contained an S^3 and S^4 concentration of the archusia, the growing organism failed in this amount, and also that an S^2 concentration failed to exist in most adult functioning tissues. These latter tissues attained these values of the archusia only when removed from the body and their circulation to the stagnant cultures.

It was again noted that the blastomeres of the egg will not grow when crowded together in the culture, as the cells of the latter period do, unless archusia is added to the medium about them. These cells contain growth inhibitors. In following these experiments farther it was found that these inhibitors existed only until the yolk left the cells. Subsequent to this period they responded readily by an independent growth when removed from the body to the stagnant culture medium. In the body at this period, however, the circulation was too

great for them to maintain, of their own accord, a concentration of S^3 of the archusia necessary for their growth.

In later embryonic and adult life, as the cells differentiated, it was noted that they again failed to respond as easily to crowding and stagnation as in the earlier periods. The acts of migration, differentiation and function were also analyzed more fully. It was found that when the cell shows these changes in the presence of an S^2 concentration of the archusia in the cultures they do not grow nor form any new substances. On the other hand, it has been fully shown that the migration of these cells, the storing of fat, function, and the building of extracellular fibrils by the connective tissue (the matrix of bone, the tendons and the connective tissue fibrils) are the result of the cells liberating a soap-like substance, which is readily absorbed by fats and proteins and causes the coagulation of the proteins absorbing it. This is the ergusia noted above. It decreases the surface tension of the cell in the presence of proteins and fats. It is the energy transforming factor in migration and function. Large quantities of this soap are used in function, in the storing of fats in the cells, and in the building of extracellular fibrils in the body. The extracellular fibrils of the body are only extracellular proteins, fibrinogen, coagulated by the ergusia.

When connective tissue cells are crowded together in a drop of plasma in the culture they digest the fibrinogen, grow and divide under the influence of the high concentration of archusia which they are able to form and maintain. When fewer cells are added to the clot and the archusia reaches only a value of S^2 they migrate into the clot and coagulate the clot to fibrils. These cells form no ergusia under these conditions. They can perform these latter acts, therefore, for only a few hours or days. They shrink in size and quickly become exhausted under these conditions. Muscle tissue contracting in the culture also becomes exhausted of its ergusia in a few hours or days. Only when these cells are transformed into growing cells are they able to recuperate from this loss.

In the functioning tissue the ergusia is apparently lost. In differentiation, in the storing of fat and the building of extracellular substances, it is combined with the proteins and fats and becomes a most integral part of the body.

In the light of these latter studies we wondered whether our deductions in relation to the cultures were correct. If they were, how did function maintain for so long a period in the organism? What allowed the differentiated cells to remain active over many years in spite of the loss of the ergusia from them? What was the nature of the inhibitors in the egg and in the cells of the later periods of life? Was the lack of archusia and ergusia made good from outside sources?

It was in the further analysis of the nature of the archusia and the ergusia that the answers to these questions were obtained. It was found that the archusia of other cells in nature can replace readily that formed by the body cells themselves. The archusia needed for the early development of the egg and the maintenance of body structure is obtained from without. It is the Vitamin B of the food (Burrows and Jorstad) (5) (6) (7). The ergusia lost to the functioning cells of the organism is replaced by Vitamin A. Vitamin A is a product of protoplasmic synthesis of growing cells in nature. It acts, therefore, to inhibit these reactions of growth when added to a growing system.

As noted above, it has been found here in the laboratory (Jorstad) (8) that drops of coal tar dissolve the ergusia of the cells. In dissolving the ergusia they drag the cells to them and cause the cells to degenerate. Noting this fact, Jorstad then found that this degeneration from the loss of ergusia can be prevented in the cells by feeding the animals on a diet rich in Vitamin A (9).

These latter facts show very conclusively, therefore, that the source of ergusia to the cells of the normal organism is Vitamin A.

We further found that bacteria during their active growth liberate large quantities of Vitamin B, but no Vitamin A. When these bacteria are allowed to overgrow the medium in a stagnant culture and their archusia (S), or Vitamin B, reaches a concentration greater than S^3, they break down. Vitamin A is liberated only under these latter conditions.

In the light of these findings it becomes evident that normal growth, differentiation and function of the body is dependent on the presence of a growth stimulus carefully balanced by growth inhibiting substances. These substances, from further analysis, are evidently only Vitamins B and A. Cancer, as we have shown above, is the result of an overcrowding of cells and a reduction in blood supply, or the establishment of conditions suitable for an overabundance of archusia, or Vitamin B, in the mass. It is the result, therefore, of a break in the balance of these two substances or to an excess of Vitamin B at a point (10).

As noted in this and shown in other papers, cancer may be induced by coal tar, other lipoid solvents, extracts of cancer (11), bacteria, certain animal parasites, as well as X-rays and radium. Extracts of cancer rich in archusia, animal parasites and bacteria produce this result by stimulating the cells to grow at the points of inoculation without the formation of blood vessels and intercellular substances. This growth is induced by the addition of an excess of Vitamin B. Coal tar, as indicated above and shown in other papers, produces the same result by removing the ergusia, or Vitamin A, and pulling the cells together into a mass.

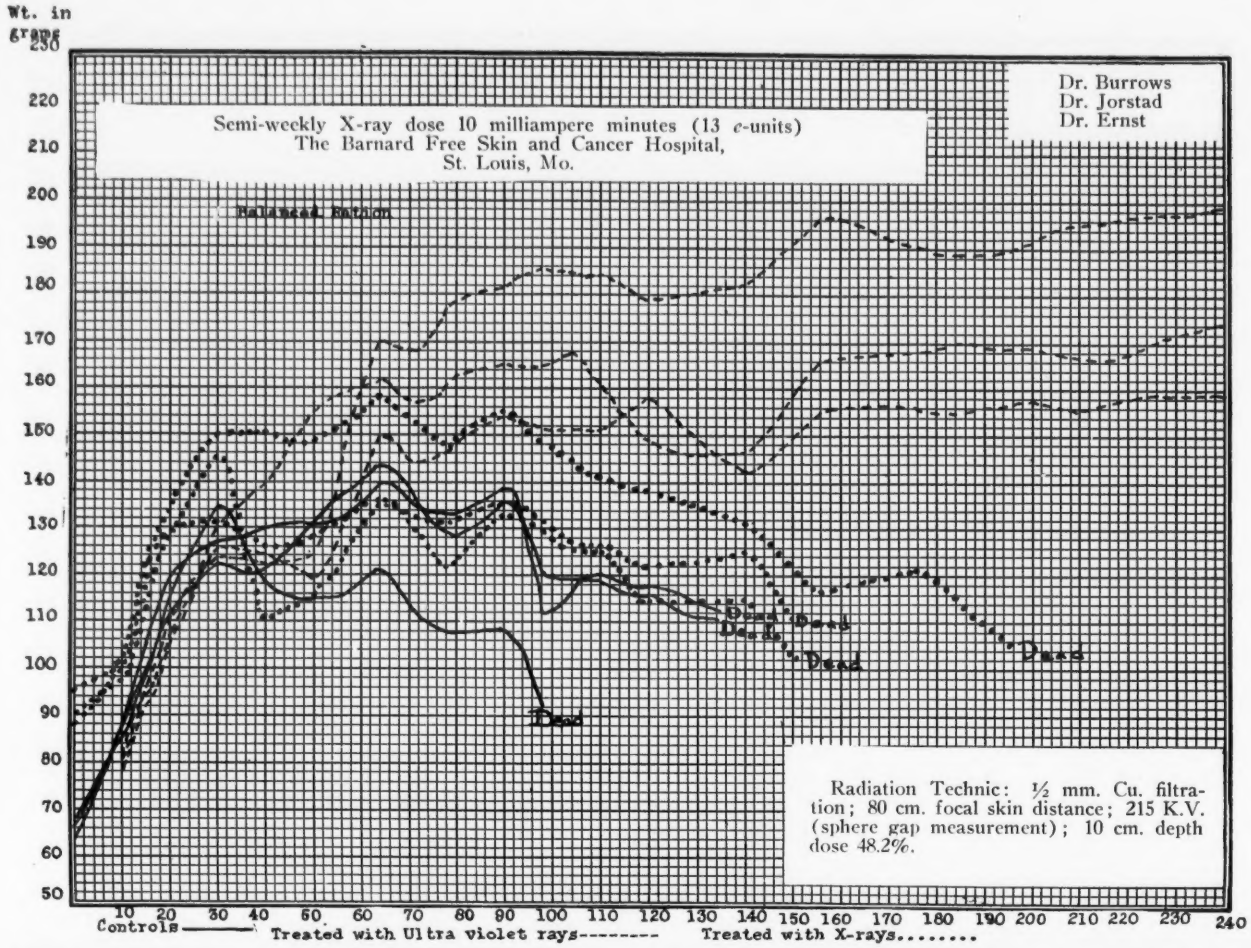
Knowing these facts, it becomes possible, therefore, to study for the first time the action of X-rays and radium on the organism. It is known that these rays not only induce but destroy cancer. We have shown above that an excess of the archusia (S), or Vitamin B, liberated at a point in the normal tissue, overcomes the inhibiting action of the ergusia, or Vitamin A, and leads to an active proliferation of cells. This same increase in Vitamin B, or archusia, added to an already growing tissue, causes a rapid digestion and destruction of the cells (11). The cancerous tissues are already rich in Vitamin B, or archusia. They contain this substance in concentrations of S^3. It became of interest, therefore, to see if we could prove more definitely that these rays act only to increase this substance in the organism. In the previous paper (1) we had already given evidence of this deduction. In this paper we give the evidence which has accumulated since this earlier paper was published.

In all these experiments we have tested the rays on rats, fed on a balanced dietary and diets deficient either in Vitamin A or Vitamin B, respectively. Previous authors have shown very definitely that rats can live for a short period only and cannot grow on a diet deficient in these vitamins. It has also been found that rats grow readily and normally on the following dietary:

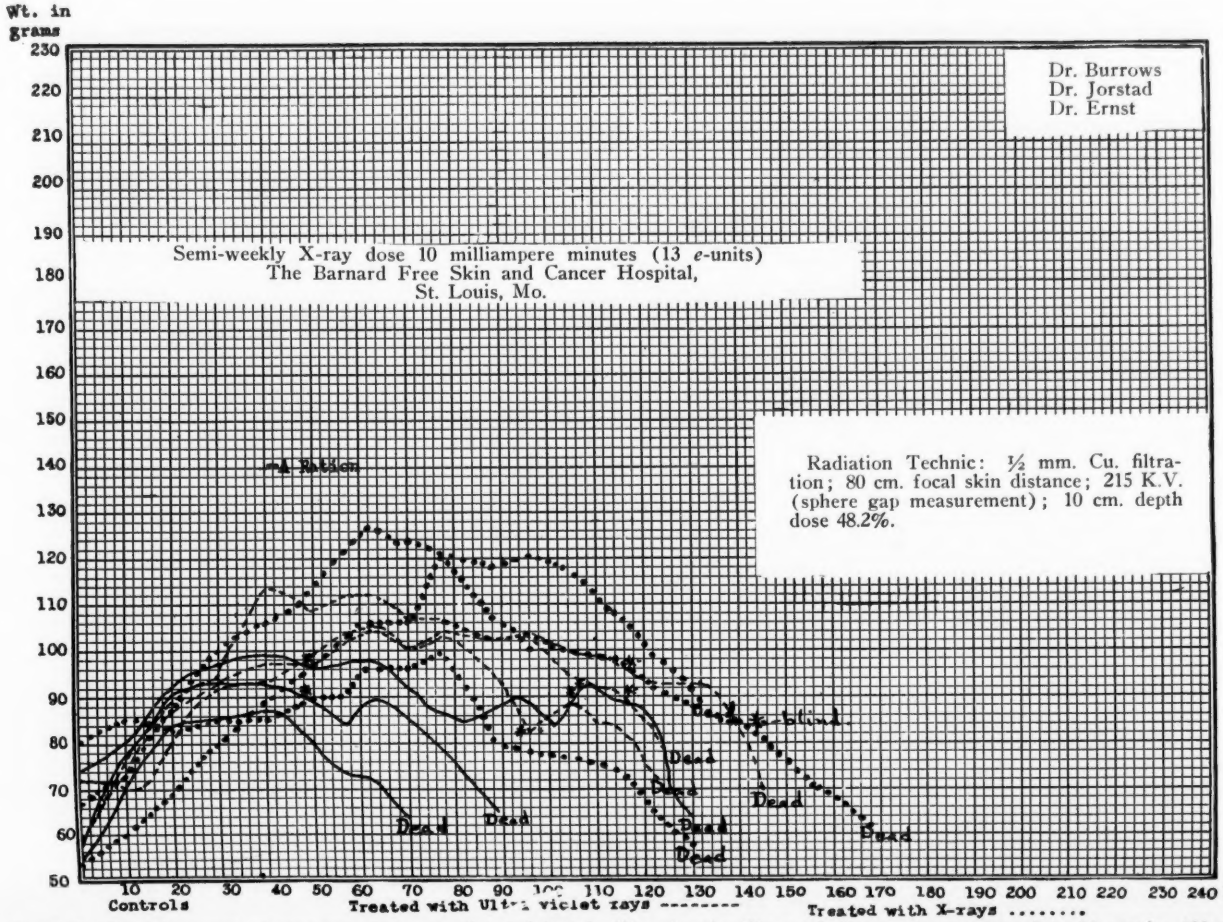
Potato starch	80 grams
Egg albumin scales	50 grams
Salts (McCollum)	10 grams
Butter	30 grams
Vegex (an autolyzed yeast product)	10 grams

Rats need no Vitamin C for their growth. In the above diet the Vitamin A is supplied, together with fat, in the butter. Vegex is the only source of Vitamin B. This diet can be made deficient in Vitamin A by substituting Crisco in equal quantities for the butter, and deficient in Vitamin B by leaving out the Vegex. Young rats fed on either of these deficient diets lose weight and succumb in from thirty to a hundred days.

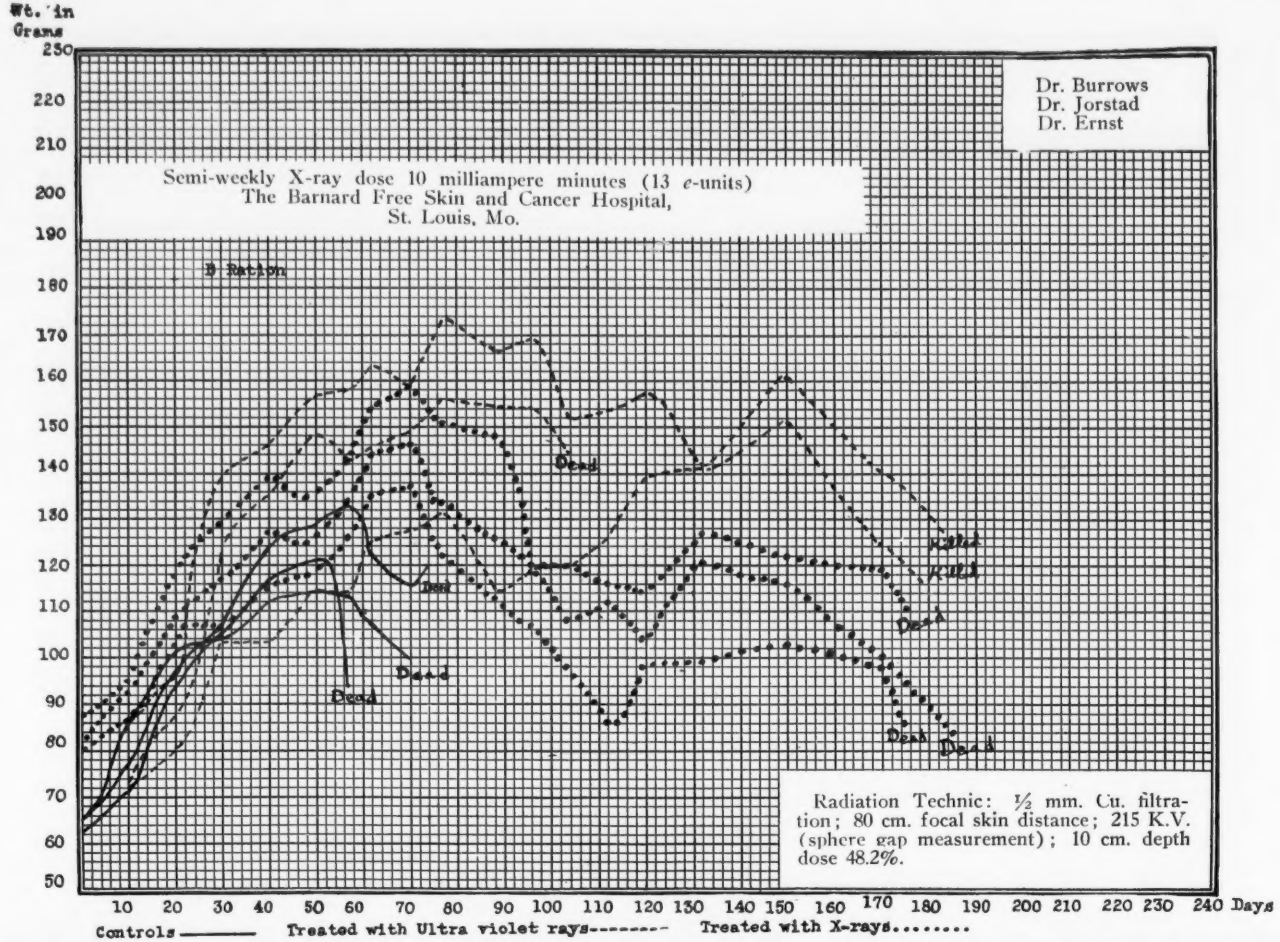
We found in our earlier experiments that rats which had been fed for fifteen to twenty



Curve 1. Growth curves of nine rats fed on a *balanced dietary*. Three of the rats were exposed to 13 *e*-units (10 milliampere minutes) of X-rays twice a week. Another three were exposed for ten minutes twice a week to ultra-violet light by means of an air-cooled mercury quartz vapor lamp at a focal skin distance of 10 inches.



Curve 2. Growth curves of nine rats fed on a diet *deficient in Vitamin. A.* Three of the rats were exposed to 13 *e*-units (10 milliampere minutes) of X-rays twice a week. Another three were exposed for ten minutes twice a week to ultra-violet light from an air-cooled mercury quartz ultra-violet lamp placed 10 inches from the animals.



Curve 3. Growth curves of nine rats fed on a diet *deficient in Vitamin B*. Three rats were exposed to 13 *e* electro-static units (10 milliampere minutes) of X-rays twice a week. Another three rats were exposed for ten minutes twice a week to ultra-violet light from an air-cooled mercury quartz lamp placed 10 inches from the animals.

days on diets deficient in either Vitamin A or Vitamin B were more resistant to large killing doses of X-rays than the rats fed on the balanced dietary, and that the rats fed on the diet deficient alone in Vitamin B were more resistant than those fed on the diet deficient only in Vitamin A.

In other experiments smaller doses of X-rays were given to similar groups of rats after they were beginning to lose weight on the deficient diets. We found in each instance that the rats recovered temporarily from the effects of the deficient diets when sufficient X-rays, 205 *e*-units (150 milliampere minutes), were given, and that this recovery was much more marked in the cases of the Vitamin B deficient animals than in those fed on a diet deficient in Vitamin A.

This temporary recovery in the case of the animals fed on a diet deficient in Vitamin A need not indicate any direct effect of the rays on this vitamin. It is possible that this is only a secondary effect from an excessive production of B in these cases. In the above experiments it has been shown that Vitamin A is liberated from the cells as they suffer destruction from an excess of Vitamin B.

In proof of this conception we have found that repeated small doses of X-rays increase the length of life of animals fed on a diet deficient in Vitamin B, while they have little effect on the animals fed on a diet deficient in Vitamin A. These facts are illustrated in the accompanying growth curves 1, 2 and 3. These curves are completed from an experiment already reported in part in the earlier paper. In this experiment we used 27 closely related young rats. These rats were first divided into three sub-groups. The first of each of the sub-groups was fed on a balanced dietary. The second of the sub-groups was given a diet deficient in Vitamin A, and the third a diet deficient in Vitamin B. The first of the main groups was kept for control. The second was exposed to ultra-violet light twice a week. The ultra-violet was obtained from an air-cooled mercury quartz vapor lamp. The exposure was 10 minutes at a distance of 10 inches.

The third group was given 13 *e*-units (10 milliampere minutes) of X-rays twice a week at 215 peak K.V., 80 centimeters focal skin distance, 0.5 millimeter copper filtration (see method of measurement of one of us, Ernst).

Unfortunately these rats developed a skin disease manifested by a loss of hair and scaling. The control animals, fed on a balanced ration, died of this disease at an early period. Those treated with X-rays also succumbed early, while those treated with ultra-violet recovered completely and are living and normal to date (Curve 1).

The growth curves of the animals fed on a diet deficient in Vitamin A are given in Curve 2. While two of the controls died earlier than the other rats, these small doses of X-rays (13 *e*-units) had little effect on the life of the rats.

The more striking effects of both the ultra-violet and the X-rays are seen in the animals fed on a diet deficient in Vitamin B, as shown in Curve 3. Two of the controls were dead after 56 to 70 days: the third had lost weight. This rat then received a balanced ration: his subsequent growth is, therefore, not given. He succumbed to his skin disease in spite of this change in dietary at about 170 days.

The lives of all the animals, treated with either the ultra-violet or the X-rays, were prolonged, except the one treated with ultra-violet. The ultra-violet treated animals were killed at the time of the death of the X-ray animals, because they would not have lived more than a few days.

In another set of three groups of animals, started on March 7, 1925, we studied the effect of large doses of X-rays repeated at long intervals. Four animals were used in each of the three groups. The first group was fed on the balanced ration, the second

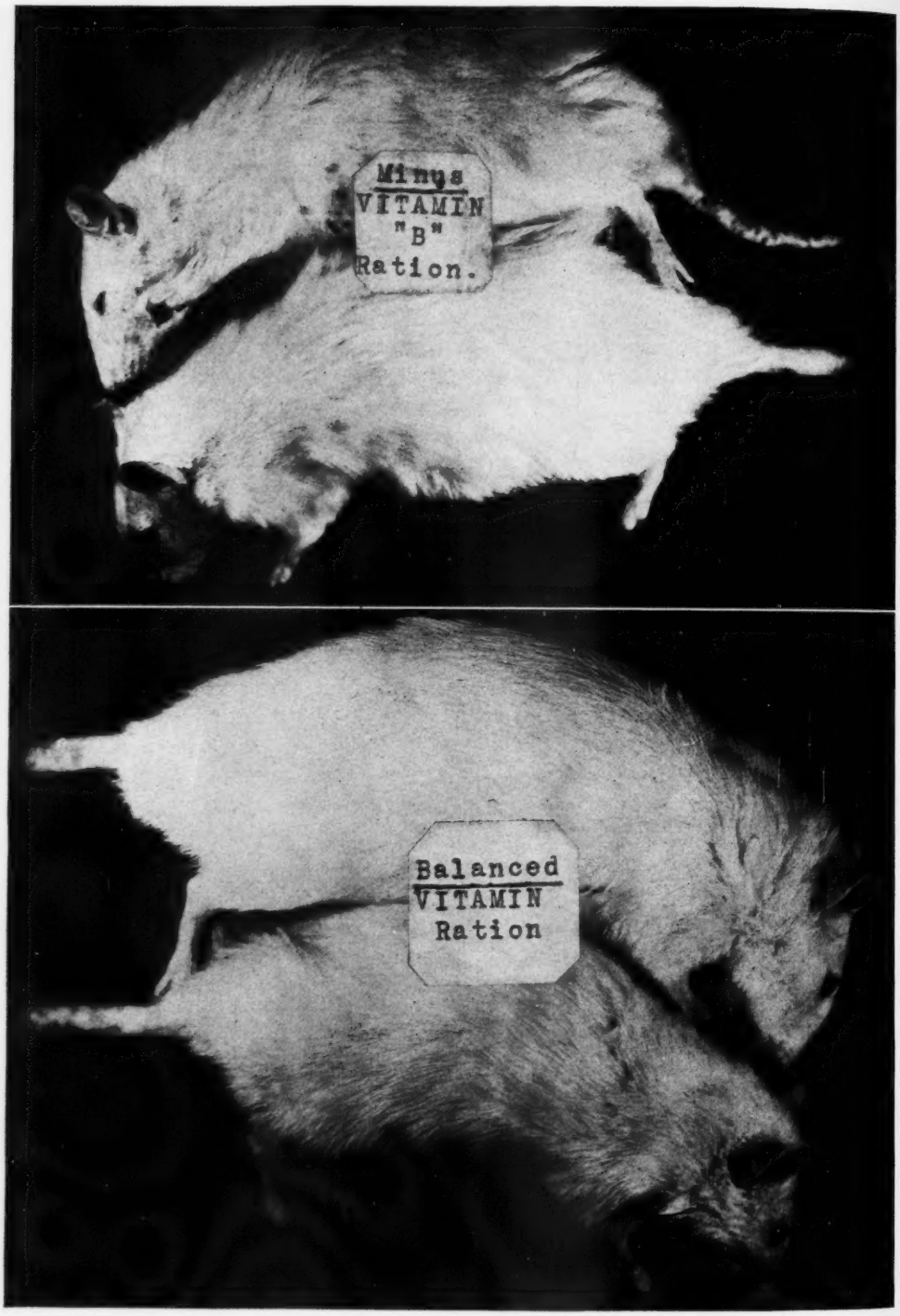


Fig. 4. The *two upper rats* were fed on a minus Vitamin B ration beginning March 7, 1925. In twenty days these rats began to lose weight and 205 *e* (electro-static) units of penetrating X-rays were administered. At intervals of two months, respectively, additional similar dosages were administered. Subsequent to each radiation the rats regained approximately their normal weights.
The *two lower rats* are the controls. They were fed on a balanced diet.

received the diet deficient in Vitamin A, and the third the diet deficient in Vitamin B. The animals fed on the deficient diets were losing weight after 20 days. At this time they were given 205 *e*-units (150 milliampere minutes) of X-rays. While this dose had little effect on the animals fed on a diet deficient in Vitamin A, it restored to normal growth the rats fed on the diet deficient in Vitamin B. At the end of May, 1925, all of the animals fed on a diet deficient in Vitamin A, and two of the animals fed on a diet deficient in Vitamin B, had succumbed. The controls and the other two animals fed on a diet deficient in Vitamin B were living and doing very well. Early in June, 1925, the rats on the diet deficient in Vitamin B and four of the controls were given 205 *e*-units (150 milliampere minutes) of highly filtered X-rays. This immediately increased the growth of the rats on the deficient dietary. During the hot summer three of the controls died. The others lived. The rats on the deficient dietary have not grown so large as the controls, but they continued to be otherwise healthy until about two weeks ago, when they began to show evidence of loss of weight. Figure 4 is a photograph of these rats, together with a female rat which had received no X-rays but had been fed on the balanced ration for a period of six months. The rats fed on the balanced diet are perfectly normal in size. The rats fed on the minus-B ration are males. They are not as large as the males fed on the balanced ration but are otherwise normal after this long period of eight months, which is five to six months longer than our animals have survived when fed on the minus Vitamin B ration alone.

SUMMARY

It has been possible by these means to throw light for the first time on the nature of the action of X-rays on the organism. As has been learned from the study of vitamins elsewhere and our own recent experiments on the generalized effects of an increase in Vitamin B on the organism, it is possible to explain the intestinal disturbances and the rise in temperature effected by X-rays. Many previous authors have noted the stimulative effects of Vitamin B. We have found that many of the changes in the tissues and the fever caused by infection are to be related directly to the excess production of this vitamin by the bacteria. Therefore, as we have seen it, the whole effect of X-rays may be resolved to these same terms. Whether ultra-violet light will be found to act differently we do not know. The above experiments indicate that its effect is also similar as far as the cell is concerned.

The practical problem of restoring the vitamin balance in a limited number of clinical cases has been very instructive, and the immediate combined effect upon these same patients under X-ray treatment has been even more strikingly favorable—sufficient, at least, to warrant further extensive investigations in the direction of effectively controlling the metabolic dietary measures in cancer patients when radiation therapy is indicated.

REFERENCES

1. Burrows, M. T., Jorstad, L. H., Lunsford, C. J., and Ernst, E. C. (July, 1925): Studies on the biological effects of X-rays and methods of measuring X-ray dosage. Read before the International Radiological Congress, London.
2. Burrows, M. T. (1913): Tissue culture *in vitro*. XVII Int. Cong. Med., Gen. Path. and Path. Anat., London, 217: Tissue culture as a physiological method. Trans. Cong. Am. Phys. and Surg., 9, 27.
3. Burrows, M. T. (1924): Factors regulating cellular growth and their significance in the explanation of cancer. South. Med. Jour., 1923, XVII, 232; Studies on cancer, 4 papers, Proc. Soc. Exp. Biol. and Med., XXI, 94.
4. Burrows, M. T., and Johnston, C. G. (1925): The action of oils in the production of tumors. Arch. Int. Med., XXXVI, 295.
5. Burrows, M. T. (1925): Studies to determine the biological significance of the vitamins. Proc. Soc. Exp. Biol. and Med., XXII, 241; Jorstad, L. H. (1925): Vitamin feeding and coal tar

stimulation. Jour. of Mo. St. Med. Assn., XXII, 338.
6. Burrows, M. T., and Jorstad, L. H.: The source of Vitamin B in nature. Am. Jour. Physiol., June, 1926, LXXVII, 1.
7. Burrows, M. T., and Jorstad, L. H.: The source of Vitamin A in nature. Am. Jour. Physiol., June, 1926, LXXVII, 1.
8. Jorstad, L. H. (1925): The behavior of coal tar in adult and embryonic tissue. Jour. Cancer Research, IX, 232.
9. Jorstad, L. H. (1925): The relation of the vitamins to the reactions induced by coal tar in the tissue of animals. Jour. Exp. Med., XLII, 221.
10. Burrows, M. T.: Studies on the cause, prevention and treatment of cancer. Read before the South. Med. Soc., Dallas, Texas, November 11, 1925.
11. Burrows, M. T. (1924): Is cancer a true disease or merely the result of a change in the organization of the organism? Radiology, IV, 407.
12. Duane, W.: Measurement of dosage by means of ionization chambers. Am. Jour. Roentgenol. and Rad. Ther., May, 1923, pp. 399-405.
13. Beets, H. N., and Arens, R. A.: Practical aspects of X-ray measurement, with special reference to a standard unit of dosage. Radiology, March, 1924, pp. 172-179.
14. Beets, H. N., and Arens, R. A.: Physical measurements and comparative technic in relation to biological dosage, Preliminary Report. Radiology, Oct., 1924, pp. 293-296.
15. Holzknecht, Guido: The safety value of the direct measurement of the surface dose in X-ray therapy. Radiology, Feb. 1924, pp. 56-61.
16. Friedrich, W.: The problem of ray dosage. Am. Jour. Roentgenol. and Rad. Ther., Jan., 1923.
17. Fricke, H., and Glasser, O.: Studies on the physical foundations of roentgen-ray therapy. Am. Jour. Roentgenol. and Rad. Ther., May, 1924.
18. Failla, G.: A brief analysis of some important factors in the biological action of radiation. Am. Jour. Roentgenol. and Rad. Ther., Nov., 1924.
19. Weatherwax, J. L., and Leddy, E. T.: Further studies of ionization measurements of roentgen-ray intensity. Am. Jour. Roentgenol. and Rad. Ther., Aug., 1924.
20. Ernst, E. C.: A practical method for the routine determination of the quantity and quality of X-rays. Radiology, Dec., 1925.

DISCUSSION

Dr. H. J. Ullmann (Santa Barbara, Calif.): I do not think we can appreciate the value of this work unless we have been fooling along—I say fooling because a lot of us are doing just that—with work that ties up with this. I have read some of the purely biological work published a short time ago on the same subject; I am absolutely fascinated by it. Dr. Ernst used a dose which to me was rather surprising. Was that dose 210 *e*-units a day?

Dr. Edwin C. Ernst: No; the amount of radiation given was 13 *e*-units or 10 milliampere minutes twice a week and the other series of rats received 75 and 150 milliampere minutes, respectively (102 and 203 *e*-units), in single doses.

The series of rats receiving 75 milliampere minutes of X-ray did not show marked changes, but those receiving 150 milliampere minutes did show the desired Vitamin B effect. Two of these rats are still alive, although they should have died six months ago.

Dr. Ullmann: These are very young rats, and you naturally would expect, as they are going to have a larger amount of ergusia than the older rats, that the difference between a growth and an inhibition dose would be very small. In order to keep these rats growing faster than the control, you must use a very much smaller dose than Dr. Ernst was using, and a very slight increase in that, a dose approaching Dr. Ernst's dose, in a young rat, will cause it to grow less fast than the control. That brings in the stimulating point. I would like to know if Dr. Ernst has any explanation as to the effect, which has been reported, when the entire organism is radiated with small doses supposed to produce a slowing of the growth of the tumor, that is, a beneficial result. Has he tied that up with this work?

Dr. R. H. Stevens (Detroit): This work of Dr. Ernst, Dr. Burrows and their collaborators, it seems to me, is important—some of it the most important work that has been done along this line—because it seems possible, with their conclusions, to correlate many of the theories we now have of cancer. The tar irritation, bacterial irritation, X-ray irritation, etc., apparently produce Vitamin C. This work also explains, in part, some of the work that has been done

by Erwin Smith and his *bacillus tumefaciens* patients in producing so-called plant cancer. It would seem to suggest an improved technic in the radiation treatment of cancer and to emphasize the importance of the dose; that this may be, not alone a matter of physics, but of biology and chemistry as well. I wish to congratulate Dr. Ernst and his co-workers on this important work.

DR. ERNST (closing): In reference to the effect of pressure upon localized animal tissue cells I wish to state that considerable research work has been done along these lines. The direct result of limiting the circulation to a part or group of cell structures by mechanically reducing the blood supply, as well as the blood outlet, has been observed to stimulate cell proliferation or tumor growths following the injection of a very small amount of active tissue fluids. Under normal conditions this same amount of tissue fluid would have little or no effect upon cell growth.

I recently observed the work of a number of Continental investigators and was allowed the privilege of checking their technical procedures and methods of producing tumor growth in animals. In every instance, however, there was employed, in addition to the specific factor or bacteria, an irritant similar to *kieselguhr* or some other active tissue fluid. All of these researches further indicate the relationship which we attempted to show between the vitamin concentration of the fluid surrounding the cells and the resulting normal or abnormal cell behavior.

The interesting chick embryo studies clearly show this relationship of the normal function of cells when surrounded by tissue fluids containing Vitamins A and B in proper proportions. However, when Vitamin B is abnormally increased, depending, of course, upon the degree of concentration, the individual cells will be found to show proliferating tendencies and excessive tumor growth takes place, as in cancer. However, if the concentration of Vitamin B is still further increased, the cells and other structures degenerate to a liquid mass. Hence, the importance of studying the biological effect of X-ray and the production of Vitamin B in the tissues.

In reference to the rats which we have employed, it is necessary that each one shall be carefully weighed. Furthermore, their ages must be uniform, neither too young nor too old. We have made a few experimental observations on rat tumors, but at the present time we are having our hands full attempting to study, first of all, the fundamental vitamin problems. The question of X-ray dosage in the rat and the corresponding vitamin effect has likewise received a great deal of attention. To a limited extent clinical cases of cancer have been studied from the viewpoint of their degree of vitamin imbalance. The various leukemias especially respond more readily and effectively to radiation after the vitamin balance has been clinically returned to normal.

Of course, we are trying to determine the more desirable vitamin balance suitable for X-ray therapy and the local lesion and hope some time in the near future to be able to be of greater service to you from a practical standpoint.

DEVELOPMENT OF KNOWLEDGE OF RADIANT ENERGY AS APPLIED TO MEDICAL USES

By C. I. REED, Department of Physiology, Baylor University Medical School, Dallas, Texas

PRIMITIVE man evidently had some sort of idea of the importance of sunlight—the only form of radiant energy he recognized—in human health and welfare, for all primitive religions contained some element of sun worship. The Greeks and Romans prescribed empirically in many conditions the extensive application of sunlight. However, it is probable that most of their "sun bathing" represented merely a popular fad. Whatever scientific knowledge of the influence of radiant energy that may have been gathered among the ancient peoples was lost sight of during the medieval period, characterized as it was by almost complete disregard of all hygienic principles.

The first recorded instance of any attempt to employ any kind of radiation in disease was made by John Gadsden, who treated small-pox patients—among them a son of Edward I—with red light to prevent scarring. This method seems to have been extensively practised by the Chinese and it is probable that Gadsden adopted it as a purely empirical procedure.

In 1661, John Evelyn, in his "Fumifugium," uttered a scathing denunciation of the practice of burning "sea coal," which produced a dense cloud of smoke. However, his diatribe was probably prompted by æsthetic considerations rather than any scientific understanding of the unhygienic exclusion of sunlight.

The first really scientific contribution to the problem of radiant energy was made by Newton in his careful study of the spectrum visible when a beam of sunlight was directed through a prism. However, his results were not understood or applied practically until a much later date, and Newton died without knowing that radiations fall into a series differing only in wave length and frequency. Some time later Römer determined that light travels at a finite velocity. In 1678, Huygens propounded the theory of wave propagation of light.

In 1777, Scheele noted that chlorine was liberated from silver chloride in the violet region of the spectrum. Two years later Ingenhauss showed that the dissociation of carbon dioxide by green leaves under the influence of sunlight is a chemical effect and not, as previously supposed, due to heat alone. These results were not fully understood until, in 1801, Ritter announced the discovery of the ultra-violet region of the spectrum, basing his conclusions on observations similar to those of Scheele but overlooked by the latter. A year previously Herschel had noted that a thermometer hung just outside the visible limits of the red end of the spectrum was markedly affected, which led to the discovery of the infra-red or dark heat rays.

The next few years witnessed the evolution of Grothus' law of photo-chemical absorption: "Only rays absorbed are effective in producing chemical change." This law was based on the fundamental investigations of the effects of light on various inorganic chemical compounds and on vegetable dyes.

Coincidentally with these developments there was a revival of interest in heliotherapy. The treatment of ulcers by sunlight was undertaken by Faure in 1774, and of wounds and inflammations by Le Peyre and Le Comte in 1776, by Bertrand in 1779, by Cauvain in 1815, and in the following year Döbereiner undertook the development of phototherapy, or artificial light baths. The application of this method of treatment to tuberculosis was probably first made on a rational scale by Bonnet, of Lyons, in 1845.

In 1832, Picton described a case of *erythema solare*, a skin eruption occurring in persons sensitized to sunlight by some unknown cause.

In 1859, Charcot showed that the effect of sunlight on the skin is independent of heat and must, therefore, be due to ultra-violet rays.

In 1861, General Pleasanton undertook some experiments, the results of which were not published until 1876. These consisted of the use of blue glass in a grapery roof to the extent of about one-third of the surface. The result was a pronounced stimulation of growth of vines. He next employed the same procedure with young pigs and was able to show considerable acceleration of growth. Good controls were used in both series of experiments. These experiments were suggested by the presence in the sky of such a large amount of blue, which seemed to this author to indicate an important relationship to life and activity. Because of his enthusiastic advocacy of the potency of blue light, there was some attempt at therapeutic application, with reported success. As a hygienic measure, in many homes blue glass was interspersed with clear glass in windows. Other authors enthusiastically published alleged results along this line that were so obviously absurd as to bring ridicule upon Pleasanton's work and it soon fell into disrepute.

But about this time (1877) Downes and Blunt published the results of experiments in which a beam of light was dispersed with a prism and the various portions allowed to fall on plated cultures of bacteria. For the first time was derived definite scientific proof that light retarded the growth of bacteria, and, furthermore, that the shortest exposures necessary were in the ultra-violet region.

Several years later (1886) Duclaux was moved to announce that in his opinion sunlight is the best bactericide known. At the same time (1885) Arloing was able to show that *B. anthracis* grows better in the dark than in the light. Geisler (1891) proved the same point with regard to *B. typhosus.*

Ward (1893) claimed to have shown by means of *B. anthracis* cultures exposed to a solar spectrum selectively screened that lethal action began in the green-blue region. But subsequent experiments by other investigators indicated that temperature probably played an important part in his results, since Thiele and Wolf (1907) reported that only after the temperature was raised to 30 or 40° C. were long ultra-violet rays lethal to bacteria.

The year following Ward, D'Arsonval and Chauvin (1894) also announced that the violet end of the spectrum is most destructive. These results were confirmed by Hertel (1905), by careful energy measurements in each field.

In 1893, Niels Finsen began in Copenhagen a revival of the previously mentioned practice of protecting small-pox patients against pitting by the use of red shades on the windows of the sick room. It was believed that the scarring was due to the action of rays in the violet end of the spectrum on the pathologically sensitized skin. The study of this problem led indirectly to the use of light as a means of treatment of lupus, rodent ulcer, and tuberculous joint afflictions. The good results obtained led to the founding of the Finsen Light Institute, which continues to the present time, under the directorship of Dr. Axel Reyn, the therapeutic use of light as well as the scientific study of light biology.

Bernhard, of Samaden, in 1902 noticed that meat exposed to sunlight at high altitude did not putrefy. This led him to try the effects of sunlight on a surgical wound with such excellent results that the old practice of Faure and of Le Peyre and Le Comte was revived.

The following year Rollier opened the now famous "Sun Cure" Institution at Leysin, in the Alpes Vaudoises, which also con-

tinues in operation to the present time. Many other institutions have since been established in various parts of the world. The evidence available from such sources leaves no longer in doubt the efficacy of photodynamic therapy in certain conditions, although there has been unquestionably much excess of enthusiasm by observers untrained in scientific investigation.

PHYSICAL BASIS OF LIGHT BIOLOGY

Before undertaking a detailed examination of the later evidence available in the study of the various phases of the problem, it is necessary to examine the physics of light with relation to organic matter.

Newton's fundamental discovery has since been elaborated until it is now possible to recognize more than one hundred distinct hues in the visible spectrum. After the discovery of the two invisible portions of the solar spectrum, ultra-violet and infra-red, the next most fundamental addition to the knowledge of physics for present purposes, was the electro-magnetic theory of radiation of Maxwell, announced in 1868, together with a prediction of the existence of electric waves. In 1888, Herz showed the existence of electric waves of much greater length than the longest infra-red waves then known. Subsequent work demonstrated direct continuity between the infra-red waves and the very long waves used in radio broadcasting. On the other end of the spectrum the discovery of the very short wave roentgen rays and later of radium rays left a gap between these and the then known ultra-violet region, the lower limit of which was 2,000 Ångström units. Still later work by Schumann, Lyman, Millikan and others has bridged the gap between ultra-violet and X-rays so that now it is known that radiant energy differs only in wave length and the scale thereof extends from the longest electric wave lengths continuously to the very short wave gamma rays of radium. It is said that if a normal spectrum of this entire range could be reproduced with a visible portion one foot long, the whole would be millions of miles in extent.

The limits of the visible spectrum are not so well defined, but may be roughly stated as extending from 4,000 Å to 7,600 Å for the human eye, though the range may be extended in a resting, dark-adapted eye to include the region 3,500–8,000 Å. Similar results have been obtained for the eyes of some children. Forel (1902) states that certain lower forms, such as ants, can distinguish very short wave rays. In general, however, it may be said that rays of the wave length range 2,950–3,850 Å are absorbed by the lens of the eye, which is extremely resistant to the protein-coagulating action of this range. This absorbed energy is responsible for fluorescence in the eye. The range below 2,950 Å is absorbed by the cornea and conjunctiva and gives rise to the ophthalmias resulting from exposures to light rich in this range. Wave lengths between 3,850 and 7,600 Å penetrate to the retina and produce sensation of sight. Heat rays are absorbed by all eye media and it has been claimed that this is responsible for cataract occurring in certain occupations, such as glass blowing.

Short wave rays are absorbed by air, water, and most kinds of glass in ranges and degrees depending on a variety of factors. They are reflected from ice, snow and water. As a consequence, sunlight at high altitudes and along the seashore is rich in short wave energy, but the spectral limit of the sun does not extend below 2,950 Å. Protoplasm readily absorbs rays of the range from 3,000 Å downward as well as those longer than 8,000 Å. In the visible region unpigmented protoplasm does not absorb greatly. The epidermis 0.1 mm. thick will absorb completely below 3,000 Å. Blood serum also readily absorbs in this region. Normal blood absorbs completely up

to 4,500 Å and has two other absorption bands, at 5,400 Å and 5,750 Å, respectively.

Quartz, fluorite, silver screens, gold screens, uviol glass, and certain chemical solutions readily transmit short wave radiations. Probably the best known solution for this purpose consists of P-nitroso-dimethyl aniline.

The fraction of radiant energy absorbed in any given region of the spectrum is independent of the intensity of the beam directed toward the medium.

PHOTOCHEMICAL REACTIONS

Any consideration of photo-biophysics in the light of present knowledge necessarily involves consideration of the theory of photochemical photo-electric reaction.

The original Newtonian theory of light propagation supposed small particles to be ejected from a source of light and to impinge upon the retina to cause a sensation of light. This theory was generally superseded by that of Huygens, which stated that light is propagated by wave motion. Recently there has come about an inclination to combine these two concepts into a statement that rays of light consist of particles that advance by wave-like motion.

Now, it is believed generally that the physiological effects of light have their origin in photochemical reactions produced when light is absorbed. In order to understand this it is necessary to refer to the electronic theory of atomic structure which supposes a minute "solar" system consisting of a positive electron or proton with planetary satellites of negative electrons which revolve in definite orbits; when this solar system, which constitutes the atom, is chemically activated, some of the electrons move out to orbits farther from the central nucleus, which are eccentric in form. It is believed that these outer electrons serve as linkages of atoms into molecules or into different kinds of molecules.

Such activation may be brought about by various forms of radiant energy. Some occur only under the influence of light and are designated as photochemical reactions. Photosynthesis, as it occurs in green plants, is an example of a purely photochemical reaction.

The electron, when a part of the atom, possesses an enormous amount of stored energy. "It has been pointed out that X-rays possess the power of ejecting electrons from the substances and that they differ from light only in their wave length; the question, therefore, suggests itself whether this property belongs to all electro-magnetic wave lengths or only to very short ones. Experiment shows that when light falls on a metal the latter becomes positively charged, due to negatively charged electrons being emitted. It is found, however, that for each metal there is a certain wave length and that all wave lengths shorter than this will cause the emission of electrons, but that longer ones will not. This phenomenon is called 'photo-electric effect' and the liberated electrons, 'photo-electrons.' There is evidence to show that the ejected electrons are electrons of the atoms. . . .

"Since the attraction of the electron to the nucleus must be great, it would appear that a large amount of work must be done in removing it from the atom, and it is at present very difficult to see how sufficient energy can be obtained from the light wave for this purpose. An explanation given is that the frequency of the light wave must be such that it can act upon the electrons vibrating in the atom, if they happen to possess certain frequencies, and in some way free a store of energy. Whether the energy is stored in the electron or in the light, is, however, at present an unsolved problem. In addition to the energy required to free the electron from the atom it must possess,

when freed, sufficient energy to emerge from the metal. It has been suggested that all wave lengths may be able to free the electron from the atom, but that only the shorter ones can supply the additional energy to enable it to come out of the metal. It is found that the velocity with which the ejected electron emerges varies in proportion to the frequency of the liberating wave length, but it is independent of the intensity of the light. *The majority of metals do not show the photo-electric effect for visible radiation, but only for ultra-violet.*" (Hill.)

A positively charged surface layer is adjuvant to the ejection of electrons, but a negative charge retards the action.

It has been suggested that emission of electrons by the pigment layer in the eye causes stimulation of rods and cones in varying ranges to produce varying sensations of light and color. At any rate, light energy, when absorbed, may increase molecular motion and so cause increased temperature. If the waves are short enough to cause vibration of electrons instead of atoms and molecules, the rearrangement of configuration of electrons or even actual escape may occur. If light penetrates deeply, ionization or increased conductivity takes place inside the mass of substance. Berg and Ellinger (1922) hold that the increased sensitivity of tissues to X-rays is due to emission of electrons.

Any scientific effort to apply these facts to biological reactions must take into consideration the following factors as possible modifiers of such reactions: 1. Source of light, which determines at once the original amount of radiant energy supplied, as well as the extent of the spectrum. 2. Distance and course of rays, *i.e.*, as to whether the intensity may be greatly diminished in transmission as well as the angle at which rays impinge. 3. Influence of the medium between the source of energy and the object itself: air, glass, water or other liquid, dust, smoke. 4. Biological object itself in relation to the light, certain forms being more readily affected than others. 5. Environment of the object: air, water, high temperature, or sensitizing media.

While it has been customary to speak of "chemical rays," this phrase is an unfortunate misnomer, since any rays that are absorbed will produce chemical changes of some kind. That these reactions are often too slight to be readily detected by ordinary means does not alter the case. Under various conditions rays of various wave lengths are absorbed by biological media. This is true of visible as well as infra-red rays.

Any therapeutic effects resulting from the application of radiant energy from various sources must, therefore, be conditioned to some extent by all rays absorbed, regardless of the portions of the spectrum from which they are derived. It is, therefore, apparent that far too little attention has been paid to the physical and chemical background of light therapy, and this practice cannot fairly be said to be on a scientific basis until more of the fundamental influences involved have been worked out.

THE X-RAY IN CARDIAC DIAGNOSIS

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THE time-honored methods of clinical cardiac diagnosis have been so tested by experience that rarely does one need any of the newer mechanical accessory aids. The facts obtained from the history, physical examination and clinical course are usually sufficient for all clinical purposes.

The introduction of the polygraph and electrocardiograph have added much to our knowledge of the arhythmias, and by applying the knowledge so gained, we are able to classify most arhythmias clinically without the aid of the electrocardiograph. While not denying the interest and satisfaction of observing the graphic representation of the course of the nerve impulse through the various portions of the neuro-muscular conduction system, it is only rarely this information adds useful facts to the clinical data.

Nevertheless, it could not be dispensed with, because we are able occasionally to observe in the conduction system early lesions that entirely escape clinical observation.

So it is with the X-ray examination of the heart and great vessels. This method has supplied us with facts that are invaluable, yet most of them can be elicited clinically. Like the electrocardiograph, it is essential only in diagnosing specific cases. Both methods add mathematical accuracy to careful observation and reasoning.

The careful clinician will make use of both methods so that all possible information may be obtained. By so doing, it is surprising how often additional facts are elicited, often facts of academic interest only, but nevertheless serving to stimulate more accurate clinical observation. Many times these accessory aids reveal the key to the situation and bridge the gap that so often exists between clinical reasoning and absolute facts.

The purpose of this paper is to review some of the possibilities of X-ray diagnosis of lesions of the heart and great vessels.

Many of the phenomena observed with the X-ray yield so much more accurate information than clinical methods that we may compare the witnessing of a football game or listening to the report of one over the radio. Both methods result in a record of the facts, but the first gives a visual impression of the affair that remains indelibly stamped upon the brain, while the latter makes it necessary to draw upon the imagination or store of former experiences to gain a proper perspective. How tiresome it would be to listen to a radio report of a football game if one had never witnessed a game!

So it is with the clinician; an accurate vision which has been obtained by observing the heart beat, can be recalled in many cases without actually seeing the image upon the screen.

Two methods are available in the X-ray study of the heart and great vessels—radiography and fluoroscopy.

Radiography has the advantage of making a permanent record of the size, shape, and position of the heart and great vessels, but has the disadvantage of not recording movements. A record of the actual size of the heart is made by taking films at a distance of two meters. At this distance the rays from the focal point of the tube are almost parallel, or sufficiently so for clinical purposes. The error is only about 3 per cent, which is negligible. Exposures can be made from various angles to record the facts pertinent to the case.

Fluoroscopy enables the observer to study the anatomical features and, in addition, the function. It is the difference between the

still life and the moving picture. If the method is combined with orthodiagraphy, a permanent record can be made.

Orthodiagraphy (Figs. 1 and 2) is the method of drawing an outline of an object

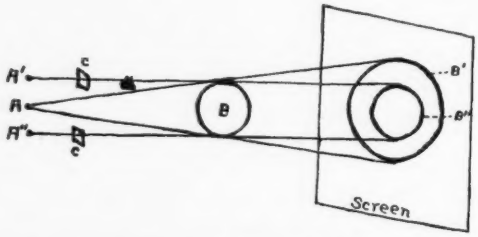

Fig. 1. Diagrammatic sketch to illustrate divergent and parallel rays. A, A', A'' = different tube shifts; B = body; B', B'' = size of body on screen; C = small diaphragm to insure parallel rays.

in actual size upon the fluoroscopic screen. A specially constructed fluoroscope is necessary, one with a fixed screen and a movable tube. The ray emerges through a small diaphragm to insure the use of parallel rays; the tube is moved from place to place around the object to be recorded; dots are made upon the screen at close intervals until the entire outline is dotted upon the screen. The dots are then joined into a continuous line and transferred to semi-transparent paper. The outline of the heart and thorax can be made very quickly, one to two minutes being required, depending upon the skill of the operator. Tracings can be made from any angle to record the necessary data. With a little practice the operator becomes quite accurate and the record is as valuable as the radiogram.

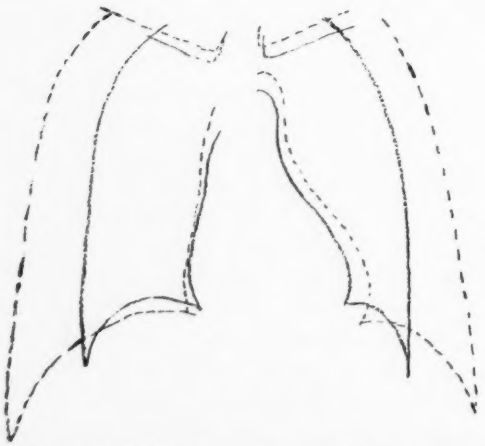

Fig. 2. Solid line represents actual size of heart and chest by orthodiagram; dotted line represents size of heart and chest by ordinary fluoroscopy.

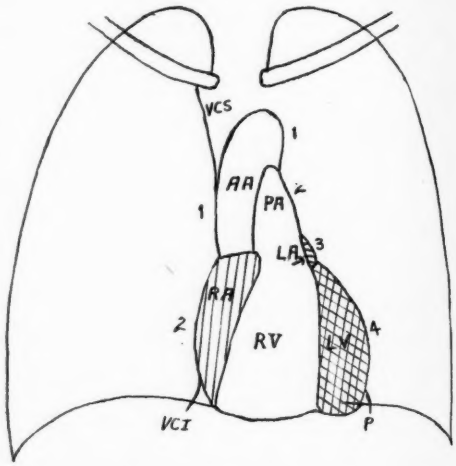

Fig. 3. Diagrammatic heart. (Adapted from Assmann, "Roentgen Diagnose Innere Krankheiten." Right border: 1, Ascending aorta; 2. Right auricle. Left border: 1. Aortic arch; 2. Pulmonary artery; 3. Left auricular appendage; 4. Left ventricle. VCS = vena cava superior; VCI = vena cava inferior; P = pericardium; RV = right ventricle.

THE CARDIAC SHADOW (ANTERIOR POSTERIOR VIEW) (Fig. 3)

The right border of the cardiac shadow is made up of two components, the right auricle and the ascending aorta. The division between them is represented by a shallow indentation at a point midway in the shadow. Each describes a convex arc, the auricle extending about one centimeter farther to the right than the aorta. Sometimes the shadow of the superior vena cava is visible in the upper portion of the shadow, beginning at about the level of the second rib and running upward and outward,

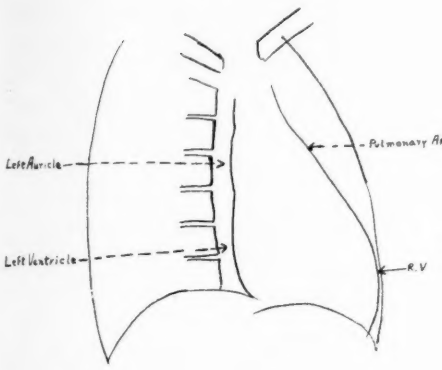

Fig. 4. Right anterior oblique (diagrammatic).

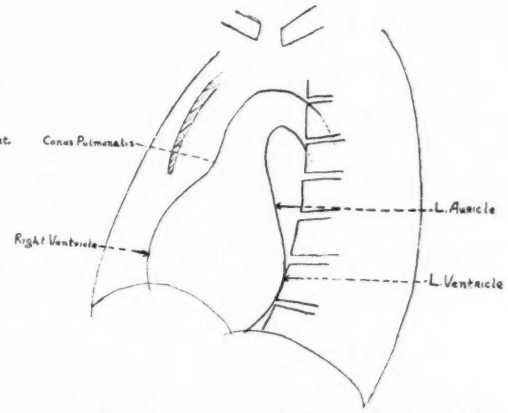

Fig. 5. Left anterior oblique (diagrammatic).

to disappear in the denser shadows of the neck. The inferior vena cava is also seen at times, during deep inspiration, in long, thin-chested individuals, in the right cardiophrenic angle.

The left border of the heart is made up of four components: the arch of the aorta, occupying the upper one-fourth; the pulmonary artery, occupying the second one-fourth; the left auricular appendage, occupying a very small portion in the shadow, and the left ventricle, occupying almost the entire lower half.

The arch of the aorta makes a variable convex arc and extends farther to the left than the pulmonary artery. The pulmonary artery makes either a straight line running downward and outward or a slightly convex arc. The left auricular appendage is not always seen; when it is present it makes a small nodular shadow immediately below the conus pulmonalis. The left ventricle describes a wide convex arc running downward and outward, to disappear in the shadow of the diaphragm. At the left cardiophrenic angle the pericardium is sometimes seen as a small, band-like shadow connecting the apex with the diaphragm. This is the only place on the cardiac shadow where it

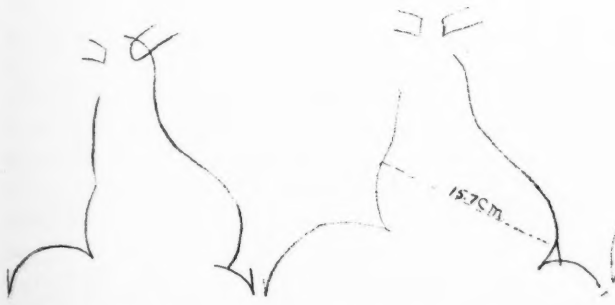

Fig. 6. Essential hypertension heart. Left ventricle hypertrophied; point is rounded; other chambers of heart normal.

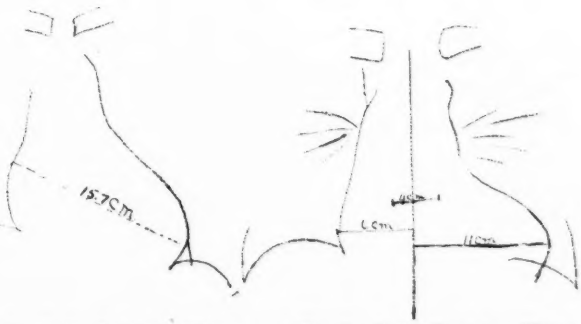

Fig. 7. Orthodiagram. Hypertrophy and dilatation, left ventricle.

Fig. 8. Orthodiagram. Hypertrophy and dilatation, left ventricle; bulging of pulmonary artery; passive congestion in chest.

Fig. 9 Orthodiagram. Mitral stenosis. Prominent conus pulmonalis; passive congestion in lungs and chest; left ventricle normal in size.

Fig. 10. Orthodiagram. Mitral regurgitation. Prominent conus pulmonalis; hypertrophy and dilatation of left ventricle; enlarged right heart.

Fig. 11. Orthodiagram. Mitral stenosis and regurgitation. Bulging conus pulmonalis and left auricular appendage; hypertrophy and dilatation, left ventricle; enlarged right heart; passive congestion in the chest.

is visible, being often mistaken for adhesions.

The superior border is made by the arch of the aorta, but is so often fused with the shadow of the trachea, esophagus, and other blood vessels that it cannot be identified.

The inferior border is made by the two ventricles. It is nearly always fused into the diaphragm shadow and is seen only when the diaphragm is very deep standing. At the juncture of the ventricles is a groove running from before backward, making a slightly concave outline.

RIGHT ANTERIOR OBLIQUE POSITION (Fig. 4)

In this position a good view of the right ventricle is obtained on the anterior surface of the shadow. The right ventricle occupies a position directly on the anterior aspect and can be viewed only from this angle. The left auricle occupies a position on the posterior aspect of the heart and is seen in this view occupying a position in the upper portion of the shadow.

The beginning portion of the aorta is well viewed from this position as it emerges from the heart shadow. The descending aorta is also seen from this position, a fact of great importance when looking for atheromata. Normally the descending aorta is rather difficult to see in a heavy patient.

LEFT ANTERIOR OBLIQUE POSITION (Fig. 5)

In this position both the anterior and posterior aspects of the left ventricle are seen. In the upper portion, the left auricle is seen just anterior to the mediastinal shadow. Many times the descending aorta is clearly seen from this position.

We may now turn to a consideration of the disturbances of these normal relationships in the presence of various valvular, muscular, and vascular diseases.

LEFT VENTRICULAR HYPERTROPHY (Fig. 6)

The left ventricle shadow extends slightly to the left and shows an increased roundness of the apex. A pure hypertrophy never increases the width of the shadows more than two centimeters. A shadow extending farther than that means displacement of the heart, or dilatation. Since the left ventricle is situated, to a large extent, well toward the posterior aspect of the

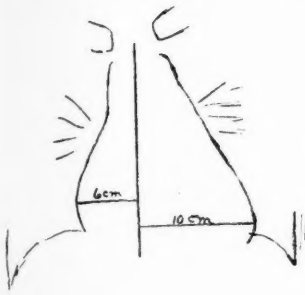

Fig. 12. Orthodiagram. Combined mitral disease, advanced stage. Enlargement entire heart, with accent on pulmonary conus and right heart.

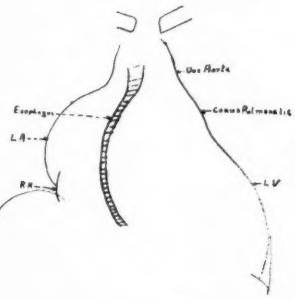

Fig. 13. Orthodiagram. Advanced combined mitral disease. Left ventricle greatly dilated and appearing on right side, above shadow of right auricle; esophagus pushed to the right.

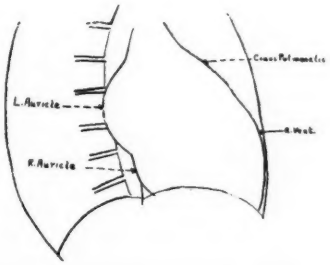

Fig. 14. Orthodiagram. Same as Figure 13, in right anterior oblique position, illustrating dilated left auricle, prominent conus pulmonalis and enlarged right ventricle.

heart, a better conception of its size can be gotten in the left anterior oblique position.

The best example of hypertrophy of the left ventricle is seen in essential hypertension, which gives the characteristic plump roundness to the apex. If there has been no break in compensation, and therefore no dilatation, the apex will be within the nipple line. It is impossible for a pure hypertrophy to displace the apex outside the nipple line. Such cases are always caused by dilatation or displacement.

LEFT VENTRICULAR HYPERTROPHY AND DILATATION (Figs. 7 and 8)

The heart shadow is greatly increased in size in the region of the apex. The apex tends to make a point, best seen during deep inspiration. The other components of the cardiac shadow may not be disturbed, but since this picture usually is seen in aortic regurgitation, the aortic shadow may be enlarged. Such a picture is called the "aortic configurated heart" or the "shoe-shaped heart," or the "lying egg." It is seen also in aortic stenosis and sometimes in hypertension.

MITRAL DISEASE (Figs. 9, 10, 11, 12, 13 and 14)

Pure mitral stenosis, theoretically, should produce an enlargement of the left auricle, due to the added work it is called upon to perform. The left auricle is so thin that it cannot hypertrophy to any great extent, and it soon dilates. With this comes a passive congestion in the pulmonary circulation, a bulging of the pulmonary artery, hypertrophy and dilatation of the right ventricle. The following changes are seen in the cardiac shadow: The left border, instead of being straight or slightly concave in the region of the pulmonary artery and auricular appendage, is bulged outward, making an almost continuous convex curve on the left border; the enlargement of the right ventricle pushes the right auricle farther to the right.

In the anterior posterior view the heart is globular in shape, the so-called "mitral configuration." Various degrees of this may be seen. It is normal in children. Sometimes the left auricle is so dilated that it appears on the right border just above the shadow of the right auricle. This is viewed

Fig. 15. Orthodiagram. Arteriosclerosis. Dilated left ventricle; enlarged and tortuous aorta.

Fig. 16. Orthodiagram. Arteriosclerosis. Dilated left ventricle; dilated aorta; prominent descending aorta; plaque encrusted.

Fig. 17. Orthodiagram. Drop heart. Low diaphragm; inferior vena cava visible, right cardiophrenic angle; pericardium visible in left cardiophrenic angle; narrow transverse diameter of heart; cardiac shadow elongated; aortic arch barely visible.

to the best advantage in the right or left anterior oblique position, the shadow of the auricle encroaching upon the mediastinal space.

In pure mitral stenosis the left ventricle is not enlarged, but such a condition is rare. Nearly always there is a combined stenosis and regurgitation; therefore, the left ventricle will also be enlarged. The typical shadow will then be a bulging of the entire left border with the exception of the aortic arch.

When the right ventricle enlarges, the heart is pushed into an abnormal position, because it cannot enlarge in a forward direction. There occurs an actual rotation of the entire heart to the left. This causes the aortic arch to almost disappear and the left ventricle may be forced to a posterior position. In this case the left border is made up of three components — the tip of the aortic arch, the conus pulmonalis, and the right ventricle. There seems to be an actual increase in the length, and a decrease in the width of the cardiac shadow. It has been called the "standing egg" heart.

The extent of the enlargement of the right ventricle can be judged best in the right anterior oblique position.

TRICUSPID INSUFFICIENCY AND STENOSIS

These lesions make an increase in the size of the right auricle or ventricle, or both. The greatest extremes of enlargement can be seen. Here again, if the right ventricle is enlarged, the heart will be rotated to the left.

CHRONIC NEPHRITIS AND ARTERIOSCLEROTIC HEART (Figs. 15 and 16)

The enlargement is to a great extent in the left ventricle, but owing to the general arteriosclerosis or breaks in compensation, the entire heart is often enlarged in all directions. In fact, general enlargement is the terminal picture in most valvular or muscular diseases. Particularly is this true if the lesion is in the left heart, or if the increased resistance is in the general circulation, such as is encountered in chronic Bright's or arteriosclerosis.

COR PULMONALE

Any condition tending to increase the work of the right heart, such as pleural thickenings, kyphoscoliosis, emphysema,

bronchiolitis obliterans, or indurative pneumonia, will result in a hypertrophy and dilatation of the right heart. The same picture is produced as in mitral stenosis. Strange to say, chronic fibrous tuberculosis rarely produces this condition. It has been explained that in tuberculosis the general tone of the entire body is so low that the heart muscle will not hypertrophy. This may or may not be true, the proof is yet to come, but the fact remains that cor pulmonale is rarely seen in chronic tuberculosis.

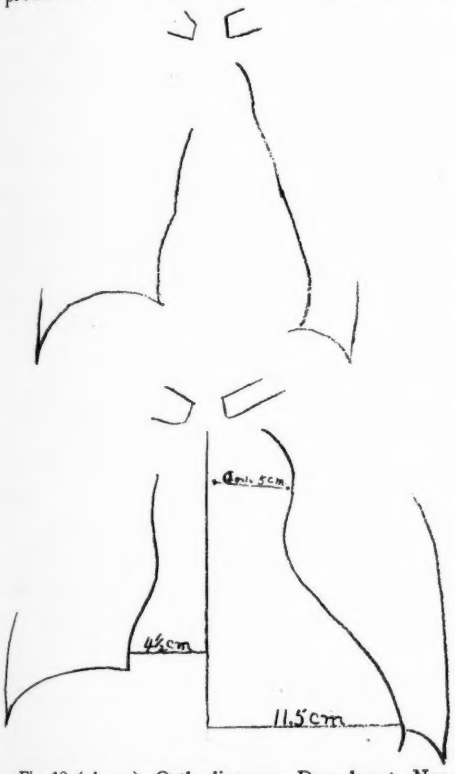

Fig. 18 (above). Orthodiagram. Drop heart. Narrow transverse diameter; prominent conus pulmonalis; aortic arch barely visible.

Fig. 19 (below). Orthodiagram. Diffuse dilatation of aorta (non-specific); aortic width 5 cm. Dilatation more pronounced in arch and descending portions. (Note relationship between right auricle and ascending aorta.) Marked dilatation, left ventricle.

DROP HEART (Figs. 17 and 18)

This type of heart is most frequently seen in emphysema or chronic tuberculosis. The heart hangs in a vertical position and appears smaller than normal. As a matter of fact, it is actually larger, the enlargement being almost entirely in the right ventricle, but owing to the left rotation of the heart and the extremely low position of the diaphragm, it appears to be elongated and narrowed.

AORTIC ENLARGEMENT (Figs. 19, 20, 21 and 22)

Mesaortitis, atheroma, or high blood pressure result in enlargement of the aorta. Mesaortitis shows a predilection to attack the beginning portion of the aorta, and the most pronounced enlargement will be seen in this area. If it attacks the aorta higher up, it usually produces an irregular enlargement (local bulgings or aneurysms).

Atheroma shows a predilection to attack the aorta more distally and produces a diffuse enlargement.

High blood pressure may appear alone or in conjunction with either disease. In either case, the aorta is diffusely dilated.

If the aorta is enlarged in the beginning portion there will be a disturbance in the relationship of the position of the right auricle and ascending aorta. Instead of the auricle extending farther to the right than the aorta, it may be on a direct line with it, or the aorta may extend farther to the right than the auricle. This is the typical appearance of mesaortitis involving the beginning portion of the aorta. This fact can be used to advantage in differentiating between mesaortitis and atheroma. The actual width of the aorta can be determined by two meter plates or orthodiagraphy. The normal values vary from one and one-half to three centimeters. Values above that should be viewed with suspicion, even in a very large individual.

Two methods are used to measure the aorta (Fig. 23):

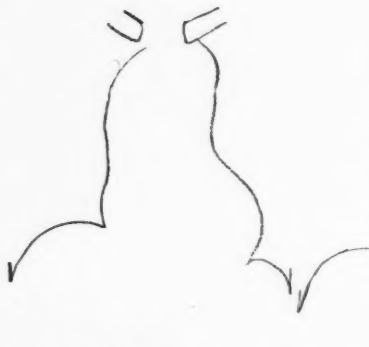

Fig. 20. Orthodiagram. Marked dilatation beginning portion of aorta (specific). Note disturbed relationship of right auricle and ascending aorta.) Heart not enlarged.

Fig. 21. Orthodiagram. Aortic regurgitation (specific). (Note disturbed relationship between right auricle and ascending aorta.) Marked dilatation, left ventricle; typical aortic configuration.

Fig. 22. Orthodiagram. Aneurysm of aortic arch. Heart not enlarged, the disease being entirely above the valves.

1. With the patient in the right anterior oblique position, the aorta is viewed as it emerges above the heart shadow. It is measured in the usual orthodiagraphic way.

2. The Kreuzfuch method. The patient stands in the anterior posterior position and drinks a small portion of thick barium mixture. At the point where the esophagus crosses the right border of the aorta, a small indentation is taken as the right border of the aorta. Its position is recorded on the screen. The tube is then shifted to the left, the parallel ray brought into line with the most prominent portion of the arch, which is also marked on the screen. The distance between these two points represents the width of the aorta at this point. The method cannot be used if the line con-

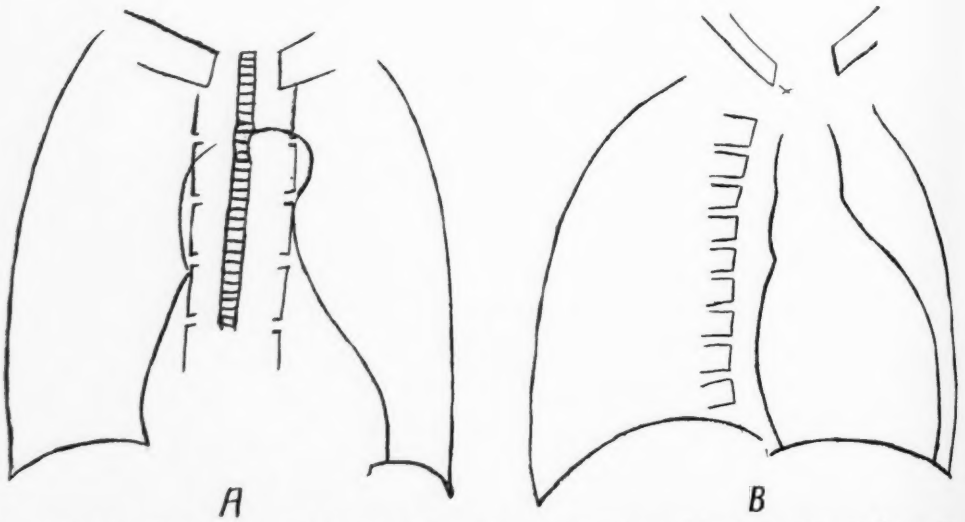

Fig. 23. Diagrammatic. *A*, Kreuzfuch's method of measuring aortic width, using esophagus as guide for determining right border. *B*, Right anterior oblique method of measuring aortic width.

necting the deepest point of the depression in the esophagus is not on a horizontal line with the most prominent portion of the aorta.

The width of the aortic arch as viewed in the anterior posterior position should not be taken as the width of the aorta. This represents a combination of the shadows of the ascending and descending portions. It is a most variable factor, depending upon the height of the diaphragm, the size of the heart, condition of the mediastinum, etc.

CARDIAC ARHYTHMIAS

Extrasystoles can be observed to better advantage by X-ray than by feeling the pulse, although differentiation cannot be made between auricular and ventricular extrasystoles.

Auricular fibrillation is easily diagnosed by observing the fluoroscopic image.

Many times, complete heart block can be diagnosed by observing the independent contraction of the auricles and ventricles.

Slight delays in conduction time cannot be seen.

The more rapid arhythmias, like auricular flutter and paroxysmal tachycardia, require the electocardiograph for diagnosis.

Space will not permit a discussion of the various congenital defects. They constitute a subject in themselves. The purpose of this paper is to draw attention to the interesting and valuable data to be obtained by a study of the more common diseases of the heart and great vessels.

The X-ray method of cardiac diagnosis will not replace the clinical method but only supplements it. Both methods furnish valuable data and can be used to advantage by the clinician.

THE TECHNIC OF THE ROENTGENOLOGIC EXAMINATION OF THE TEMPORAL BONE

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Translated by ISAAC GERBER, M.D.

THE temporal bone is one of those skeletal parts which are especially prone to variations. These may be the expression of some existing disease, such as the disappearance of cell structure in the mastoid process where there is acute otitis media with destruction; or they may be the results of some past trouble, such as the various forms of limitation of pneumatization. In spite of the importance which the demonstration of these changes has for the clinician, there is only a very scanty literature on the roentgenology of the temporal bone. The reason for this is obvious. It is only necessary to take up a skull in one's hand to see that merely the anatomical position of the temporal bone makes it especially difficult for roentgen investigation. There is no possible plane of projection by which one can bring the pyramid, for example, directly on the plate, or avoid confusion by the projection of other skeletal parts upon it. The problem is also rendered difficult by the fact that even if it were possible to obtain an ideal projection of the temporal bone on a plate, the bizarre form of this bone and the very complicated arrangement of its cavities would give an X-ray picture that would be exceedingly difficult to analyze. In addition, this bone shows much more variation in structure than any other portion of the osseous system. With regard to this latter difficulty only great experience can help. As for the other difficulties, they can be overcome by a proper, precise and definite exposure technic. In this paper I intend to go into the details of our method of examination of the temporal bone, which has gradually evolved from practical experience.

There are a number of considerations necessary before the development of a satisfactory exposure technic.

1. Projections must be so chosen that the expected changes will be demonstrated in the very best possible manner.

2. We must attempt to obtain films that will show the greatest possible sharpness of definition and richness in detail.

3. The method must be simple, and serviceable in practical work.

Just what pathological changes can and should be shown is determined from practical experience, or from the request of the otologist. Suitable for roentgen examination are all those diseases which either lead to change in the air content of the cellular system, analogous to the affections of the paranasal sinuses, or which change the structure of the bony portions in any way. These diseases can be grouped as follows:

A. Inflammatory Affections;
- *a.* Otitis media acuta,
- *b.* Otitis media chronica,
- *c.* Otitis media tuberculosa.

B. Malignant Tumors, Extending from the Middle Ear Cavities;
- *a.* Carcinoma,
- *b.* Sarcoma.

C. Basal Tumors, with Destruction of the Pyramids;
- *a.* Carcinoma metastases,
- *b.* Sarcoma,
- *c.* Acusticus tumors,
- *d.* Tumors of the dura,
- *e.* Hypophyseal tumors,
- *f.* Peritubal tumors.

D. Fractures;
- *a.* Transverse fissures of the pyramid,
- *b.* Longitudinal fissures of the pyramid.

E. Acquired Changes in the Auditory Canal;
  a. Hyperostoses,
  b. Exostoses,
  c. Atresias.
F. Congenital Maldevelopments.
G. Operative Defects.

I will now take up the pathological changes which are to be observed in these various conditions, and which can be demonstrated roentgenologically in the majority of instances, if the proper technic is used.

In *acute otitis media* we are concerned only with those cases in which the diagnosis is uncertain. For example, in some cases of exostosis it is impossible to do otoscopy satisfactorily and one must try to see if the disease of the middle ear can be demonstrated roentgenologically, either by lessening the air content of the cells or by inflammatory changes in the bones. If a definite clinical diagnosis of otitis media is made, then the determination of the air content is of minor importance. On the contrary, we are more concerned with the character of the pneumatization, the structure of the cellular system and its extent. These are facts from which the clinician can draw definite conclusions regarding the probable course of the disease. The most important of these facts is the presence or absence of destruction of the cell walls from suppuration.

Chronic otitis leads to changes in the cavities of the middle ear, particularly in the attic and mastoid antrum. The presence and extent of bony destruction can be determined, and at the same time the relation of these processes to the floors of the middle and posterior cerebral fossæ. Thus we can answer the question as to whether there is thinning or perforation of the tegmen tympani or antri, or the bony groove for the lateral sinus. Poor development of the pneumatic system is the rule in chronic otitis. The demonstration and localization of isolated groups of cells are required by the otologist. Also, in this chronic condition it is important to determine the various topographical relations in cases which are to be operated on; for example, the direction in which the lateral sinus runs, or the distance between the dura lining the floor of the middle cerebral fossa and the roof of the auditory canal.

In *tuberculosis of the ear,* we must distinguish between those cases in which the bony changes are limited to the immediate neighborhood of the middle ear, and those in which the pyramids are involved to a considerable extent. Accordingly, in one group we must bring out particularly the cavity of the middle ear and in the other the entire pyramid, and determine any degree of atrophy that may be present.

Tumors which extend from the pars mastoidea destroy at first the neighborhood of the middle ear cavities, and then under proper conditions speedily involve the labyrinth or extend through the internal canals towards the tip of the pyramid. In these conditions, therefore, not only the cellular system and the middle ear cavities must be examined, but also the entire pyramid, with the labyrinth.

Basal tumors in the majority of instances lead to a destruction of the tip of the pyramid. Acusticus tumors produce especially a widening of the inner auditory canal. In rare cases the pyramid will be widely destroyed in a lateral direction first.

Fractures usually extend either through the squama, auditory canal and tympanic cavity, or through the squama, mastoid antrum, aditus ad antrum and tympanic cavity, towards one of the larger foramina of the middle cerebral fossa. Occasionally they will extend square across the long axis of the pyramid, mostly through the facial canal and the labyrinth, or, more rarely, and in only very severe injuries, through the base of the pyramid.

Acquired disease of the auditory canal includes exostoses, hyperostoses, and atresias. The last two conditions occur rarely in

idiopathic sclerosing hyperostosis, and commonly as a result of traumas or a chronic inflammation. The trauma leads to scars of the soft tissues or a callus, which causes stenosis; while the inflammatory processes produce organized polyps which under certain conditions may also calcify.

Congenital malformations affect mostly, and to the greatest degree, the os tympanicum, although rarely the pyramid or the mastoid process may be involved.

In examining temporal bones after operation we are concerned either with the demonstration of infected cells which have been left behind or with the determination of the character of the operation which has been performed. The antrum and its surrounding cells alone may have been opened (antrotomy), or a radical excentration of the cells may have been done, or, finally, perhaps a drainage of the labyrinth may have been carried out, as in tuberculosis. Also considerable importance may be attached to the determination of whether the middle or posterior fossæ may have been opened.

If we group these changes according to their location and according to their primary disease, we obtain Table I, below.

Localized bony changes can be shown as a rule by the projection of the particular part involved. However, a comparison of the healthy and the diseased parts is necessary when we are concerned with any diffuse skeletal changes, as, for example, a lessening of the air content of the cells of one side, or decalcification of one pyramid following the extension of tuberculous granulation tissue, or a tumor mass. As we are not always able to reproduce exactly the same conditions of exposure we must often get this comparison on one single plate. Then we have a symmetrical projection of the two parts, from which some conclusions can be drawn. Two such projections can be used with the temporal bone, one for the

	Mastoid Process	Middle Ear Cavity	Tegmen and Sinus	External Auditory Canal	Pyramid and Labyrinth
Acute Otitis Media	*	*	*		
Chronic Otitis Media	*	*	*	(*)	
Tuberculous Otitis Media	*	*	*		*
Tumors of Pars Mastoidea	*	*	*		*
Basal Tumors					*
Fractures		*		*	*
Changes in Auditory Canal				*	
Maldevelopments	*	*	*	*	*
Operative Defects	*	*	*	(*)	(*)

Table I. This table shows just what portions of the temporal bones require our especial attention in the various diseases.

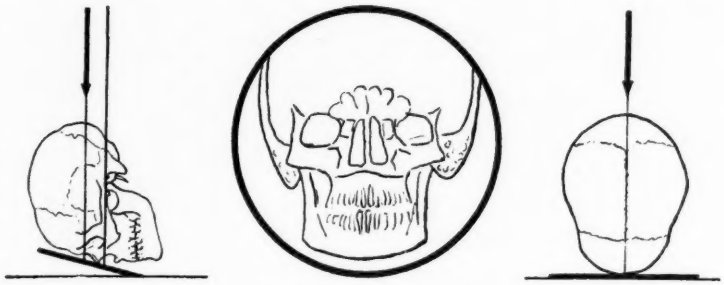


Fig. 1. Mastoid comparison.

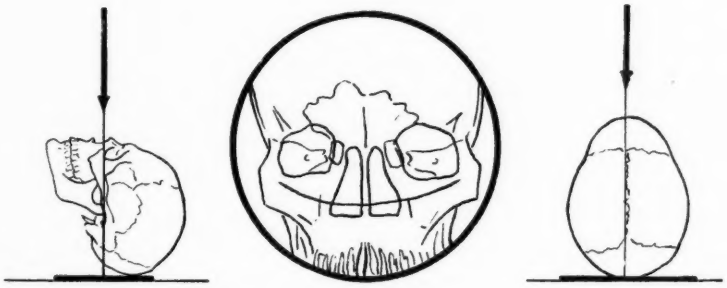


Fig. 2. Pyramid comparison.

mastoid process and the other for the pyramids.

1. *Mastoid comparison* (Fig. 1)—
   - *a.* Position of patient: Prone; forehead and nose on plate.
   - *b.* Head support: Wedge-shaped pillow.
   - *c.* Fixation: Split bandage around head.
   - *d.* Central ray runs through line where the sagittal plane meets a plane running parallel to the German horizontal plane,[1] but through the *upper* margin of the orbit.
   - *e.* Diaphragm: Iris type, upper end 7 cm., lower end 14 cm.
   - *f.* Skin-target distance: 35 cm.
   - *g.* Filter: 0.5 mm. Al.

In making this projection the short skin focus distance is especially to be noted. This is done in order to better project the mastoids away from the ascending rami of the lower jaw. As we have already stated, this comparison of the mastoids is important only in those cases where the otologist cannot use the otoscope. Of course, a comparison is possible only where both temporal bones show an essential symmetry in the structure of the pneumatic systems.

The second comparison exposure is

2. *Pyramid comparison* (Fig. 2)—
   - *a.* Position: Dorsal (supine).
   - *b.* Head support: Sand-bag.
   - *c.* Fixation: Split bandage.
   - *d.* Central ray goes through the line of intersection of sagittal plane with the German horizontal.
   - *e.* Diaphragm: Large iris, upper end 7 cm., lower end 12 cm.
   - *f.* Skin-target distance: 45 cm.
   - *g.* Filter: 0.5 mm. Al.

In this exposure the pyramids are projected into the orbits. The anteroposterior direction is used because in this projection,

[1] The "German horizontal plane" goes through the *lower* margins of both orbits and the upper edges of both external auditory meati.

Fig. 3. Temporal bone exposure of Schueller.

Fig. 4. Temporal bone exposure of Mayer.

Fig. 5. Temporal bone exposure of Stenvers.

on account of the marked distortion of the orbits, a better view is obtained of the entire pyramid than in the reverse direction. In the reverse, or posteroanterior direction, the visible portion of the pyramids is much smaller, but the small wings of the sphenoid are brought out very clearly. The first projection, therefore, is to be used when we are concerned about comparison of the calcium content of the two pyramids, as in tuberculosis or sarcoma. The reverse projection can be used when there is a suspicion of basal tumor, when we generally look for changes in the prominent parts of the base of the skull. It must be remembered that variations in the position of the pyramid occur quite often, and may produce an asymmetrical course of the upper edges on the two sides. This is not to be considered as anything indicating disease.

I will now consider the special exposures. Changes in the pneumatic system can be demonstrated better, the fewer the cells are which are projected on one another. The extension of the pneumatic cells is much greater in the sagittal direction than in the frontal. If the central ray is projected in the German horizontal plane, the two temporal bones will be projected into each other. In order to avoid this, the ray is de-

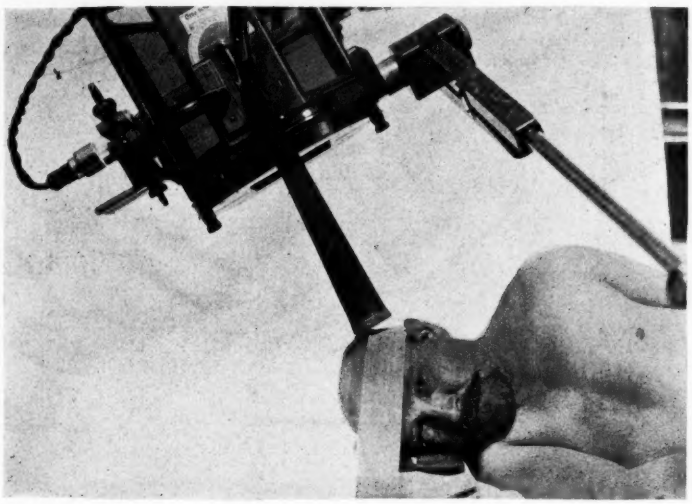


Fig. 6. Schueller's projection.

viated somewhat in the cranio-caudal direction. This oblique direction of the ray has the further advantage of bringing out the cells above the auditory canal and in the base of the zygomatic arch without being obscured by the pyramid. This spreading out of the pneumatic system is produced by the following:

3. *Temporal Bone Exposure of Schueller* (See Figs. 3 and 6)—
   - *a.* Position of patient: Lying on side; median plane of head parallel to that of plate; back support.
   - *b.* Head support: Sand-bag.
   - *c.* Fixation: Split bandage around the head.
   - *d.* Central ray runs in a plane passing through both external auditory meati, but inclined towards the meatus of the affected side, and making an angle of 35 degrees to the cranial side from the German horizontal plane (Fig. 3).
   - *e.* Diaphragm: Cone 30 cm. long with a circular opening 3 cm. at upper end and 6 cm. at lower end.
   - *f.* Skin-target distance: 45 cm.
   - *g.* Filter: 0.5 mm. Al.

Aside from the splendid general view of the pneumatic system that this exposure gives there are other important advantages. This projection shows the internal and external auditory canals, the os tympanicum, the course of the lateral sinus, and very often the tegmen, particularly the tegmen tympani. With a carefully carried-out technic the internal and external auditory meati should be projected onto one another; this can be done without any very great difficulty. With this method, the plane in which we study the temporal bone is accurately fixed. If we wish to determine from an X-ray plate the distance between two points, it is necessary that these two should be approximately the same distance from the plate, and that the central ray should be perpendicular to the line joining the two. In this projection we have just these conditions. In consequence, we can determine very accurately the distance between the sinus and the posterior wall of the auditory canal, or the space between the dura of the middle fossa, in the neighborhood of the tegmen tympani, and the roof of the auditory canal. In this projection of Schueller's, therefore, we have an ideal means of verv

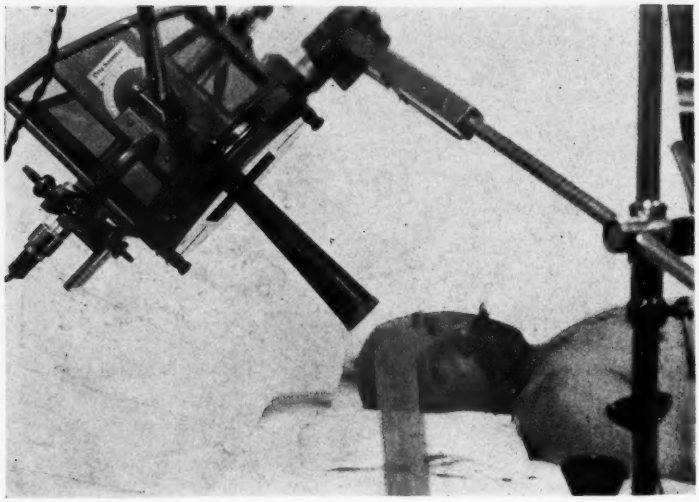


Fig. 7. Mayer's projection.

accurately determining the topographical relations with regard to the position of the sinus and the dura of the middle fossa. The demonstration of the tegmen and the course of the sinus permits us to recognize the presence of perforating destructive processes in the middle or posterior fossæ. The mastoid antrum is seen only when it is enlarged. It is very well demonstrated, however, in the projection next to be described.

4. *Temporal Bone Exposure of Mayer* (See Figs. 4 and 7)—

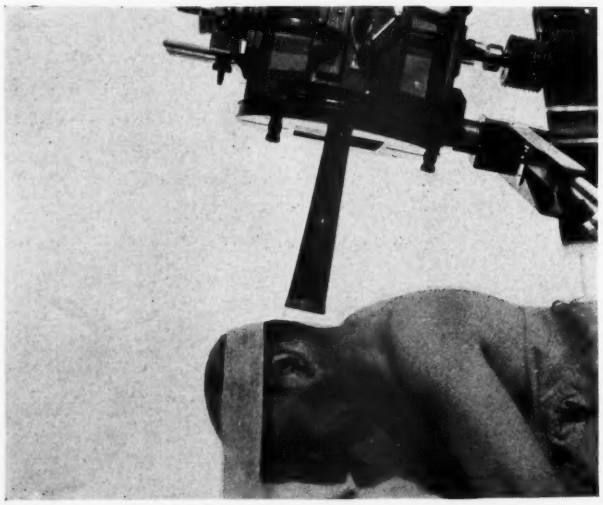
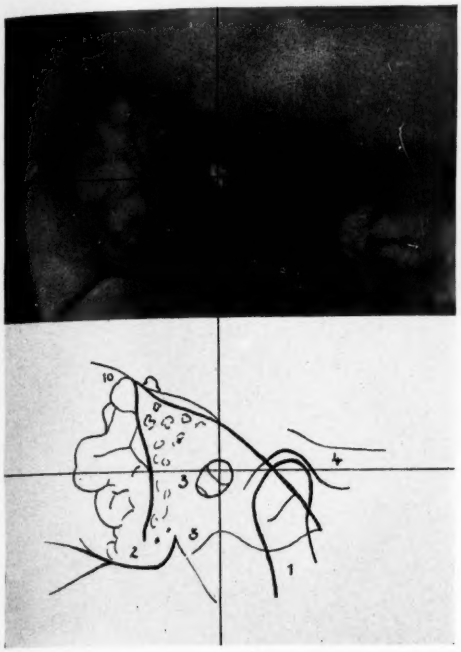
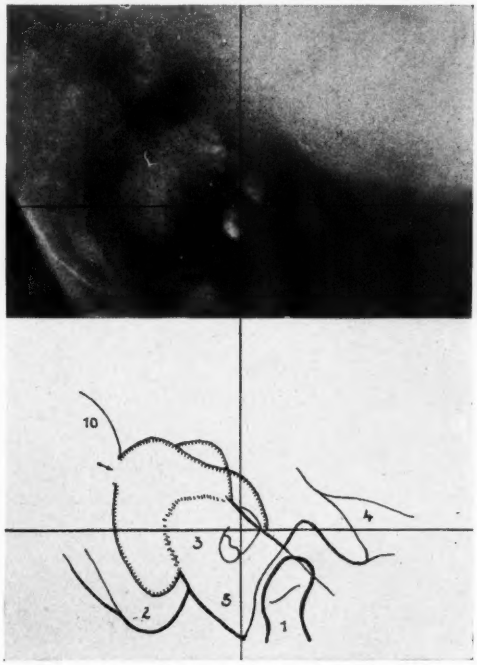


Fig. 8. Stenvers' projection.



Figs. 9 and 9*A* show a normal temporal bone, taken in Schueller's angle. The two lines cross at the point where the inner and outer auditory meati are superimposed. The upper edge of the pyramid is seen extending from the left upper quadrant, through the right upper and into the right lower quadrant. Close to where this line begins, in the left upper quadrant, another line is seen, which goes down practically in a perpendicular direction, towards the tip of the mastoid process. This is the posterior boundary of the pyramid. The cellular system of the mastoid portion of the bone is clearly seen in the two left quadrants.[2]



Figs. 10 and 10*A* are Schueller's projection in a case of chronic otitis media. In the region of the pars mastoidea in both left quadrants we observe an extensive defect with a smooth boundary, which extends into the right upper quadrant almost as far as the auditory canal. In the upper left quadrant there is a break in the contour of this defect, near the posterior fossa. This indicates that the dura in this neighborhood has been exposed.[2]

a. Position of patient: Lying on back; head turned 45 degrees towards the side to be examined; lobe of ear turned forwards.

b. Head support: Sand-bag.

c. Fixation: Split bandage around the head.

d. Central ray runs in a plane perpendicular to the German horizontal and passes through the external auditory meatus of the side to be examined and the external orbital border of the other side. The ray also forms an angle of 45 degrees in the cranial direction from the German horizontal.

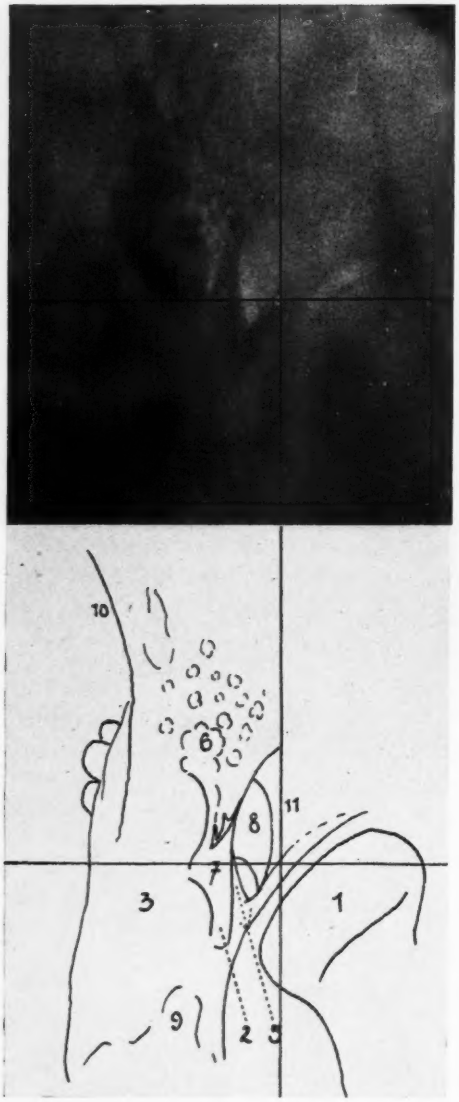
c. Diaphragm: Cone as in Method No. 3.

f. Skin-target distance: 45 cm.

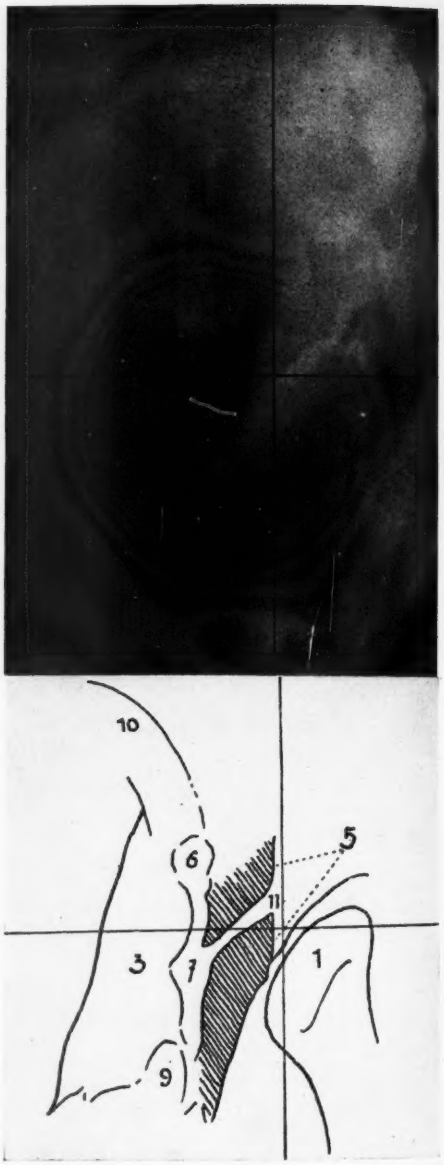
g. Filter: 0.5 mm. Al.

This projection brings out certain details of the pneumatic system that are not seen in the Schueller projection, namely, the mastoid antrum, the aditus ad antrum, and the middle ear cavity, particularly the attic or recessus epitympanicus. Also, this method gives a good general view of the auditory canal. With neither of these two methods

[2]Explanation of Figures 9*A*, 10*A*, 11*A*, 12*A*, 13*A*, and 14*A*: 1. Condyloid process of mandible. 2. Mastoid process. 3. Petrous bone. 4. Zygomatic process. 5. Os tympanicum. 6. Mastoid antrum. 7. Tympanic cavity. 8. Epitympanic recess (attic). 9. Carotid canal. 10. Lateral sinus. 11. Meatus acusticus externus. 12. Labyrinth. 13. Porus acusticus internus.



Figs. 11 and 11*A* show a normal temporal bone with Mayer's projection. The lines cross at a point in the anterior wall of the auditory canal. As is usually the case in normal bones the clear space in the antrum cannot be clearly differentiated from its surroundings. The aditus ad antrum can be seen as a light streak extending downwards from the antrum towards the tympanic cavity. It is bounded on the right by the posterior wall of the auditory canal. The tympanic cavity is projected partly over the mastoid process and the os tympanicum.



Figs. 12 and 12*A* show the same projection in a case of congenital atresia of the external auditory canal. The plate shows an extensive hyperostosis of the os tympanicum (which is shaded in the sketch, Fig. 12*A*) and a marked narrowing of the auditory canal.

is it possible to get a good view of the labyrinth, the internal auditory canal or the mesial portion of the pyramid. These are brought out in the next projection.

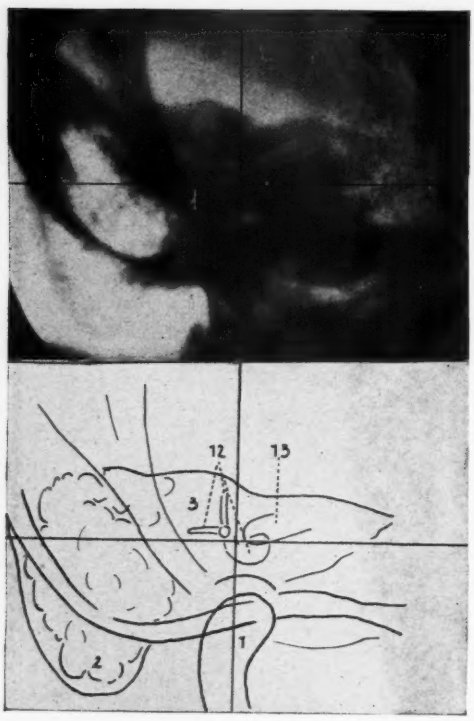
5. *Temporal Bone Exposure of Stenvers* (See Figs. 5 and 8)—
   - *a.* Position of patient: Prone on abdomen; head turned 45 degrees towards the well side; nose, forehead, and malar bone touching the plate.
   - *b.* Head support: Sand-bag.
   - *c.* Fixation: Split bandage around the head.
   - *d.* Central ray: In a plane perpendicular to the German horizontal and passing through the middle of a line joining the external auditory meatus of the affected side and the external orbital border of the other side. The ray forms an angle of 12 degrees in the dorso-caudal direction from the external occipital protuberance.
   - *e.* Diaphragm: Cone as in Method No. 3.
   - *f.* Skin-target distance: 45 cm.
   - *g.* Filter: 0.5 mm. Al.

TABLE II

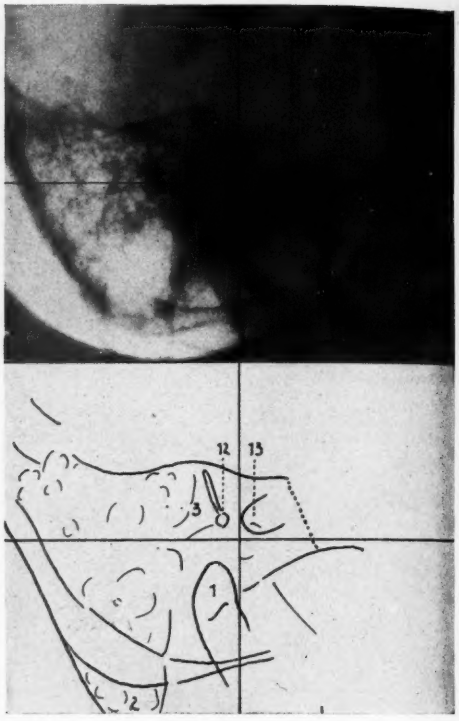
Method	Mastoid Process	Middle Ear Cavity	Tegmen and Sinus	External Auditory Canal	Pyramid and Labyrinth
Schueller	*		*	(*)	
Stenvers	(*)				*
Mayer		*		*	

TABLE III

	Schueller's Projection	Stenvers' Projection	Mayer's Projection
Acute Otitis Media	*		(*)
Chronic Otitis Media	*		*
Tuberculous Otitis Media	(*)	*	*
Tumors of Pars Mastoidea	*	*	*
Basal Tumors	(*)	*	
Fractures		*	*
Changes in Auditory Canal	(*)		*
Maldevelopments	*	*	*
Operative Defects	*	(*)	*



Figs. 13 and 13*A* show a normal bone in Stenvers' projection. The lines cross at a point in the tympanic cavity. Just to the left and above, the light streaks of the semicircular canals are seen. The cochlea lies directly to the right of the cross.



Figs. 14 and 14*A* show Stenvers' projection in a case of basal tumor, which has destroyed the tip of the pyramid.

This projection of Stenvers brings out the pyramid in an ideal projection with the least amount of distortion, and in the view that we get when we observe it from the front perpendicular to its long axis. The labyrinthine organs are all clearly shown, with the exception of the posterior semicircular canal. The internal auditory canal is also well seen. With this projection changes in the tip of the pyramid are clearly noted.

These three special exposures permit us to see all essential details. Table II shows the parts that are brought out in each of the three methods.

If we combine Table II with the first one, we get Table III, which shows the methods of projection that are best suited to the various kinds of disease.

By the proper combination of the three methods of projection we attain the first of the requirements that I mentioned in the beginning of this paper, namely, that the angles of projection must be chosen so as to bring out the expected pathological changes in the best possible manner. Naturally, cases will occur in which the above scheme will not suffice. In these instances it will be necessary to take other typical or atypical angles in order to clear up obscure details.

And now let us consider my second important requirement. How are we to obtain the sharpest and clearest possible films? The general principles governing this problem are well known to every practical roentgenologist and need no repetition here. I wish only to mention the most important of the means for getting rid of the scattered rays; these make much difference in the special

projections. Methods 1 and 2 (Mastoid Comparison and Pyramid Comparison) can be done very well with the Potter-Bucky diaphragm, if one desires. This diaphragm can also be used without special difficulty in Method 3 (Schueller) and Method 5 (Stenvers). Conditions are somewhat different, however, with Method 4 (Mayer). Here we cannot substitute for the markedly eccentric position of the tube by a corresponding change in the position of the head. Therefore, I have used another means of obtaining sharpness. Here I use a long conical tube of circular cross-section, with an upper opening about 3 cm. in diameter and a lower opening about 6 cm., the entire cone being 30 cm. long. With the narrow bundle of rays that we obtain through such a small tube the scattered rays do not play any important part. Comparison films taken with the Potter-Bucky diaphragm and with this tube, in the Schueller and Stenvers positions, showed the results to be exactly the same in the Schueller projection. In the Stenvers position, the film obtained with the small tube was much sharper than the other. The reason for this is that with the Stenvers position and the Potter-Bucky diaphragm there is an increase in the distance between the part studied and the film, and a consequent increased haziness of outline. From my experience, therefore, I prefer to use the small tube in all the three special projections, rather than any of the special diaphragms.

As the methods above described are easy to carry out practically they fulfill all the requirements which are necessary to-day in the study of such an inaccessible and complicated part of the skeleton as the temporal bone. These methods have been in use now for over three years on a large number of patients, and have proved their value.

Several reproductions of plates (Figs. 9-14) are given as examples of the work. The diagrams (Figs. 9*A*-14*A*) which accompany these plates are direct tracings of the latter. In order to make things clearer crossed lines are shown at the same point in both the diagrams and the plates. (See Footnote 2, page 313.)

LITERATURE

1. DEUTSCH and MAYER: The roentgenological examination of the temporal bone. Monatschr. f. Ohrenheilkunde und Rhino-Laryngol., 1923.
2. DEUTSCH: Roentgen diagnosis of chronic otitis. Ztschr. fur Hals- Nasen- und Ohrenheilkunde, 1924.
3. DEUTSCH: Morphology of congenital atresia. Monatschr. f. Ohrenheil. u. Rhino-Laryngol., 1925.
4. DEUTSCH and MAYER: Roentgen examination of the ear after temporal bone operations. Fortschr. a. d. Geb. d. Röntgenstr., 1925.
5. MAYER: Roentgen examination of the ear. Fortschr. a. d. Geb. d. Röntgenstr., 1923.
6. MAYER: Results of the roentgen examination of the temporal bone in diseases of the ear. Fortschr. a. d. Geb. d. Röntgenstr., 1924.
7. MAYER: Roentgen examination of the mastoid process and its clinical significance. Passow's Beitrage, 1924.
8. MAYER: Atresias of the external auditory canal. Fortschr. a. d. Geb. d. Röntgenstr., 1924.
9. MAYER: Destructive changes in the pyramid tip with basal tumors. Fortschr. a. d. Geb. d. Röntgenstr., 1924.
10. MAYER: Three further cases of congenital atresia of the external auditory canal. Fortschr. a. d. Geb. d. Röntgenstr., 1925.
11. MAYER: The roentgenological demonstration of fractures of the base of the skull. Fortschr. a. d. Geb. d. Röntgenstr., 1925.
12. MAYER: The roentgen findings in chronic otitis. Fortschr. a. d. Geb. d. Röntgenstr., 1925.
13. MAYER: A rare deformity of the temporal bone. Acta Radiologica, 1925.
14. MAYER: Differential diagnosis of destructive processes in the temporal bone, with report of a rare case of almost complete destruction of the pyramid from a cholesteatoma. Fortschr. a. d. Geb. d. Röntgenstr., 1925.
15. POLITZER and MAYER: Congenital atresia and stenosis of the external auditory canal and its origin. Virchow's Archiv., 1925.

PULMONARY FIBROSIS[1]

By CLIFFORD R. ORR, M.D., Radiologist of the Buffalo City Hospital, BUFFALO, NEW YORK, in collaboration with WILLIAM F. JACOBS, M.D., Pathologist of the Buffalo City Hospital.

THE choice of this subject was not with the idea of presenting a new thought but with a hope that, in directing your minds along old channels, I might create an interest in you as to the causes and effects of pneumofibrosis from the industrial viewpoint.

The specific relation between forms of lung disease and industrial employment has been recognized from very ancient days. Hippocrates, writing over 2,300 years ago, referred to the metal miner who "breathes with difficulty" and "is of pale and wan complexion." Agricola, writing in 1556, referred to the dryness in mines where "the dust, which is stirred and beaten up by digging, penetrates into the wind pipe and lungs" and which, "if it has corrosive qualities, eats away the lungs, and implants consumption in the body." He recognized the high mortality, too, when he wrote: "In the mines of the Carpathian Mountains women are found who have married seven husbands, all of whom this terrible consumption has carried off to a premature death." (9)

The general term "pneumonoconiosis" (πνευμον—lung, κονις—dust, ωσις—disease), meaning "dust disease of the lung," was first applied to this condition by Zenker.

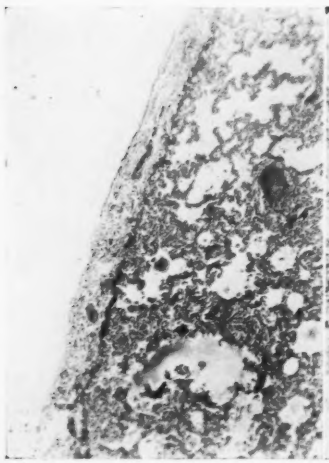


Fig. 1. Subpleural lymphatics show congestion but absence of pigmentation.

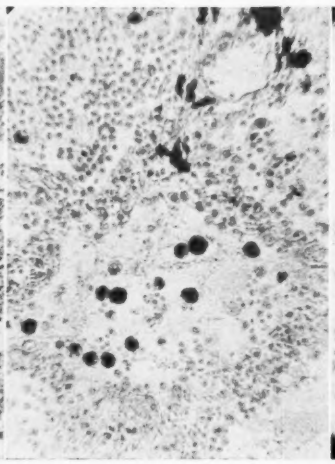


Fig. 2. Fibrosis and anthracosis, with large phagocytes (high power).

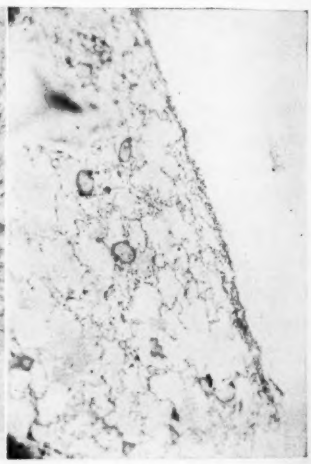


Fig. 3. Earlier stages of fibrosis and anthracosis (low power).

PATHOLOGY

Tice, (1) who classified all forms of pulmonary fibrosis resulting from the inhalation of dust, whether such dust be organic or inorganic, as coming under the head "Pneumonoconiosis," writes: "The lung tissue proper is fairly well protected from ordinary amounts of dust by the action of the

[1]Read before the Eleventh Annual Meeting of the Radiological Society of North America, at Cleveland, Ohio, December 7-11, 1925.

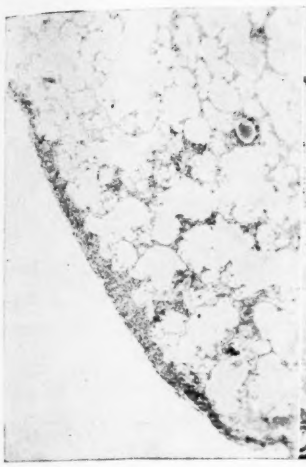


Fig. 4. Lung: subpleural lymphatics and arthracosis.

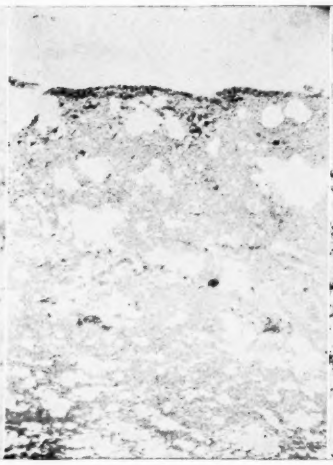


Fig. 5. Near the roots of the lung: fused bronchopneumonia, with arthracosis and fibrosis (low power).

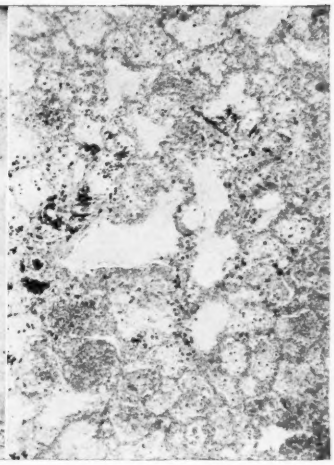


Fig. 6. Fused bronchopneumonia, with arthracosis and fibrosis. Note the phagocytic activity.

ciliated epithelium, mucous secretions, phagocytes [Fig. 2], and the cells of the bronchial tubes; but when the atmosphere becomes heavily laden with dust, the protection afforded by these various mechanisms is unfortunately insufficient."

Coplin, (2) in his description of the pathology, writes: "These pigment particles do not seem to be able to penetrate the stratified epithelium, but gain ingress farther down in the air passages; the alveoli, being permeable, and the epithelial cells not arresting all the pigment, it enters the lymph spaces of the basement membrane, from which the extraneous substance diffuses by the lymphatic channels into the surrounding

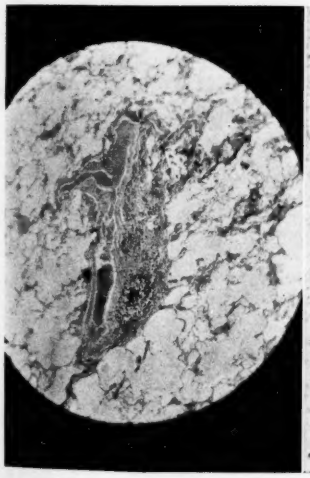


Fig. 7. Perivascular and perivesicular fibrosis.

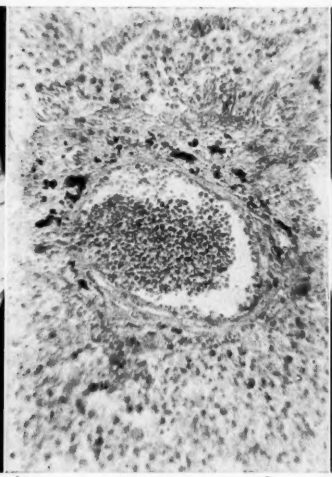


Fig. 8. Perivascular arthracosis and fibrosis.

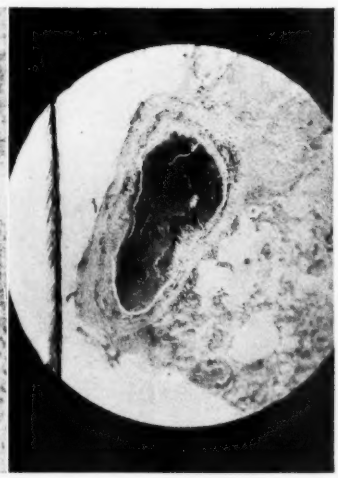


Fig. 9. Organizing thrombus, with arthracosis and fibrosis.

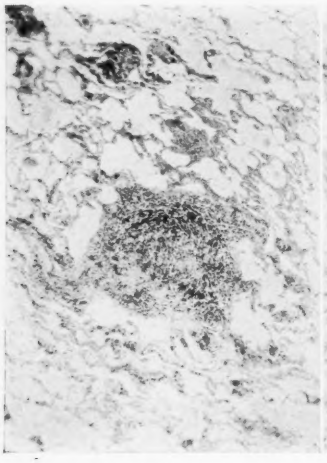


Fig. 10. Nodules of arthracosis and fibrosis.

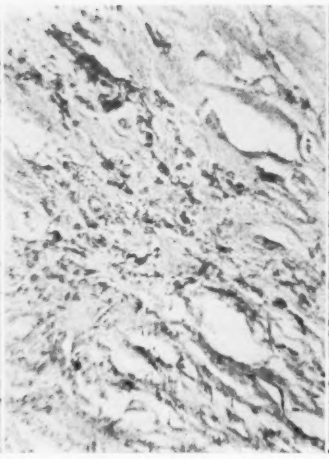


Fig. 11. Marked silicosis and fibrosis.

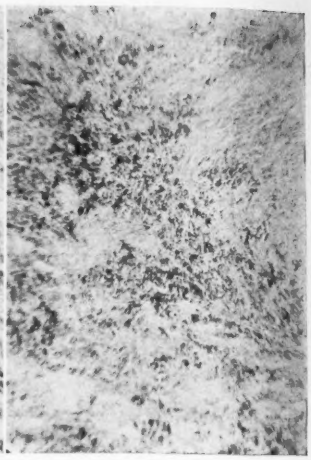


Fig. 12. Marked fibrosis and chalicosis.

tissue [Fig. 3]. The deposited material finds lodgment in the following structures: in the sub-pleural [Fig. 4] and interbronchial [Fig. 5] tissue; in the peribronchial lymph nodes [Fig. 6]; and in the lymph adenoid interspaces of the alveoli [Fig. 7].

"After the infiltration is well advanced in the pulmonary tissues, the substernal and

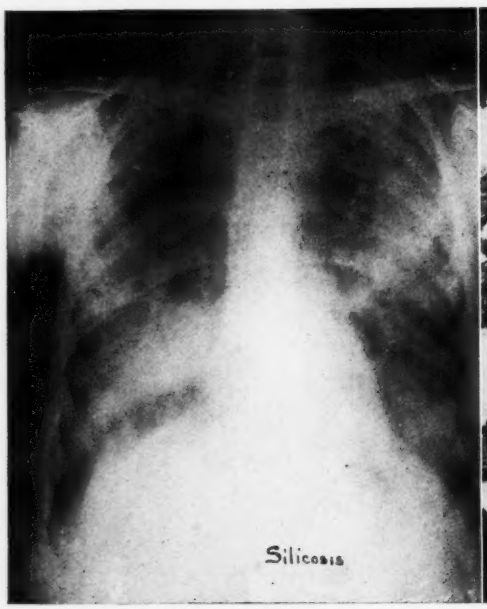


Fig. 13. Marked fibrosis and silicosis. Third stage.

Fig. 14. Marked fibrosis and chalicosis.

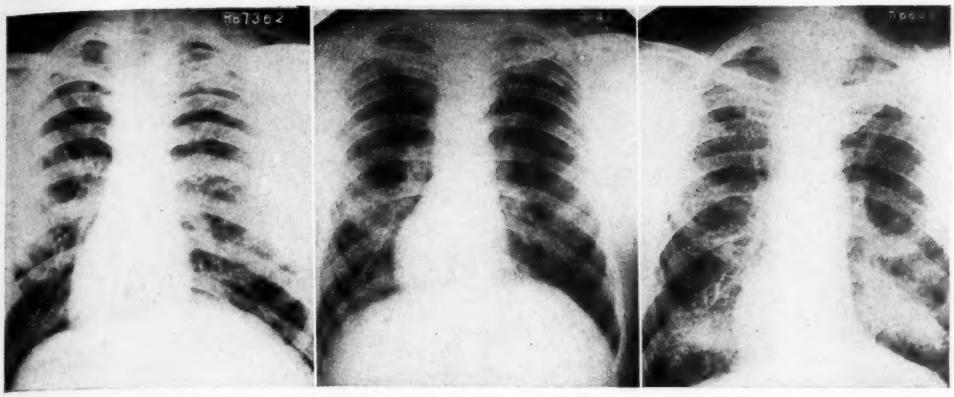


Fig. 15. Fibrosis. Patient was 3 years in coal mines; chauffeur for past 18 years. Late first stage or early second stage.

Fig. 16. Fibrosis. Patient has been carborundum worker for 10 years. First stage.

Fig. 17. Tuberculosis, fibrosis, bronchiectasis, and anthracosis. Third stage.

general mediastinal glands are usually involved. Weigert has shown that the circulation may be reached by the pigment passing through the peribronchial nodes, which attach themselves to the pulmonary veins, into which they rupture [Figs. 8, 9, 24 and 25]. The presence of foreign solid matter induces inflammation of the mucous covering—at first acute, but from the continued application of the irritant, the changes incident to chronic inflammation occur. In the deeper tissues fibroid hyperplasia ensues, with the abundant production of new fibrous tissue in the infiltrated areas [Figs. 10 and 11]. The accompanying catarrhal processes denude the epithelial protecting layer, and lung tissue becomes exposed to the dangers of infection by bacteria. The introduction of pyogenic organisms induces an infective inflammation which may terminate in necrosis, and eventually give rise to cavity formation; or, what is more common in susceptible individuals, the tubercle bacillus gains entrance to the affected tissue, and tuberculosis is engrafted on the existing lesions."

The forms of fibrosis most destructive and offensive are:

Chalicosis—due to silica dust (Figs. 12, 13 and 14);

Anthracosis—due to coal dust;

Siderosis—due to iron dust.

Chemical and aniline dye workers show the same changes. Vegetable dust may lead to similar affections, the pathological changes being identical but less pronounced than those produced by mineral dust inhalations.

The industries responsible for these dust hazards are varied and numerous; the following enumeration will serve to illustrate some of the general types responsible: Those working in stone, glass, pottery, lime, cement, brass, copper, aluminum, iron, steel, grindstone and other abrasives; saw and planing mills; those working in furs, rubber, leather, chemicals, aniline dyes, paints, textiles, carpets, rugs, wool, silk, flour, and tobacco; city scavengers; miners of coal, zinc, lead, and gold; grain elevators, and other allied industries.

DUST SUSPENSION

Dr. Lanza (3) sets a standard of one milligram of dust per 100 liters of air as the maximum amount of dust of the industrially caused type that the air may without injury contain.

Paul M. Holmes (4) reports that Greenburg and Greenburg calculated that the workers in the facing room of a certain abrasive manufacturing establishment in Ni-

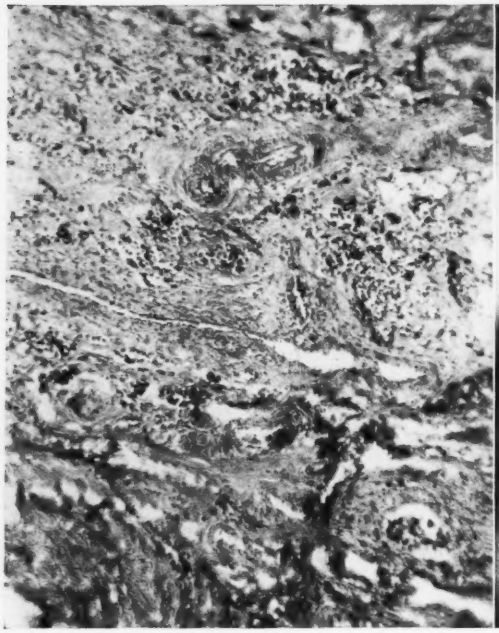


Fig. 18. Carcinoma; marked arthracosis and fibrosis.

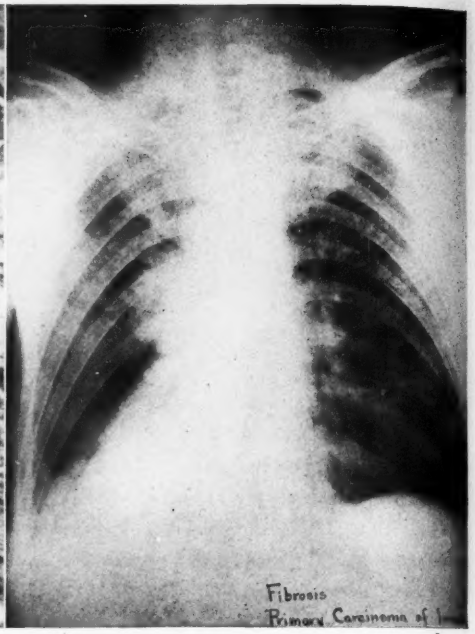


Fig. 19. Primary carcinoma of the lung, and fibrosis.

agara Falls breathed a total of 144.6 milligrams of abrasive dust every 12 minutes, a total almost exactly 100 times the maximum amount set by Dr. Lanza as the maximum under which the worker can retain his health. Holmes' tabulations show that the dust suspension ranges from 0.9 of a milligram per 100 liters of air, or beneath the maximum allowed, in the office, to a grand total of 233.5 milligrams of dust to 100 liters of air in the shaving room, a total 233 times that set as the maximum. The average for the whole shop was 44.3 times what it should have been.

The Journal of Industrial Hygiene (8) in a report on "Dust Hazard," made a study of the largest abrasive and grinding wheel factory in the world, and reported that a dust-removal system installed in the factory was resulting in the removal of 12,000 pounds of dust daily.

As an example of the effect of such dust inhalation on the workers, Winslow and Greenburg (5), in a study of this hazard in the wet and dry grinding shops of an ax factory, report that forty years ago the grinders were Yankees and were able to grind from eighteen to twenty years before giving up to "grinder's consumption." The Yankee was succeeded by the French Canadian who was able to work from twelve to sixteen years. The Swedes followed, working from eight to ten years, and to-day, the Finns and Poles are at it, lasting usually from three to five years.

These dust particles are suspended in the air of the workroom as a result of the process of manufacture, and they are breathed constantly by the occupants of those rooms, producing changes in the pulmonary mechanism which are, at first, acute, then become latent, and finally, chronic.

STAGES

The first, or primary, stage of fibrosis is one with which the roentgenologist will sel-

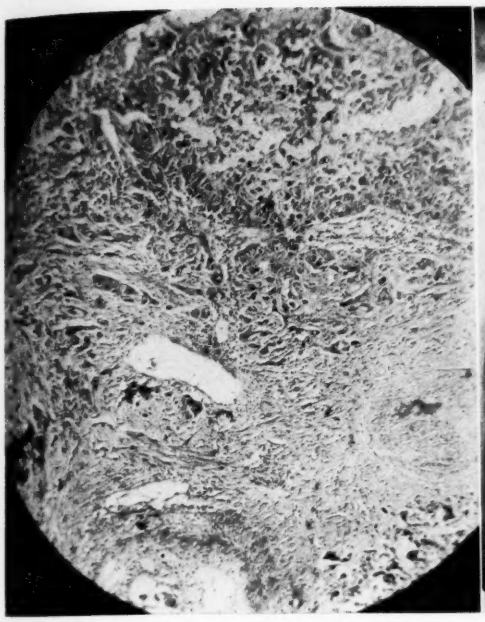


Fig. 20. Marked fibrosis, with primary carcinoma of the lung.

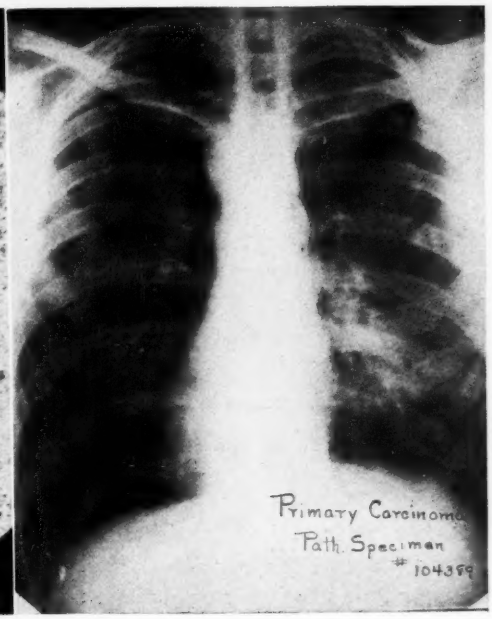


Fig. 21. Fibrosis; primary carcinoma of the lung.

dom, if ever, come in contact. It is manifested by acute respiratory disturbances and is registered radiographically by increased hilum and root shadows (Figs. 15 and 16).

In the second, or latent, stage, the lung has for the time accustomed itself to the presence of dust, and at first gives no symptoms, but later as fibrosis develops the *X*-ray reveals the characteristic mottling, and symptoms of pulmonary embarrassment appear (Fig. 22).

The third, or chronic, stage is characterized by marked fibrosis, bilateral pulmonary semi-consolidation, with areas of aeration at the apices and bases, thickened pleura, lowered resistance and poor circulation (Fig. 13)—conditions predisposing to bronchiectasis (Fig. 17), bronchiectatic cavity, tuberculosis, abscess, gangrene, and even to a primary carcinoma, supposedly due to the fibrous tissue cutting off islands of lung tissue. In our series, autopsy has revealed three such cases (Figs. 18, 19, 20, and 21).

Tuberculosis (Figs. 17 and 23) is the most prevalent infection, and, unfortunately, seems to be on the increase. Winslow, (6) in an article on factory ventilation and industrial tuberculosis, gives tables of mortality which show a steady increase of pulmonary tuberculosis among granite cutters and ax polishers. These tables show an increase of 3 to 1, between the years of 1899 and 1918, in the case of the granite cutters, and an increase of 12.7 to 1 in the case of the ax grinders in a Connecticut factory during the same period. Jarvis, (7) quoting vital statistics covering a period of twenty years, pointed out that 86 per cent of the granite cutters in Washington County died of tuberculosis.

Anthracosis (Figs. 24 and 25), on the other hand, seems to yield statistical evidence directly opposite to that of silicosis, the mortality rate for tuberculosis in the mining districts being considerably less than that in the rural districts. But, in spite of

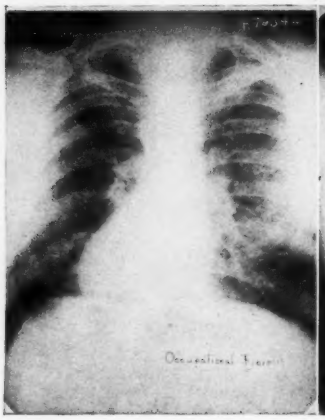


Fig. 22. Occupational fibrosis. Second stage.

Fig. 23. Miliary tuberculosis. Note similarity to Figure 22.

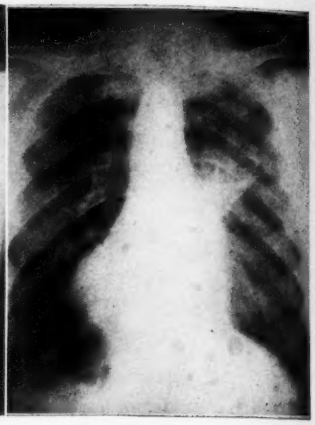


Fig. 24. Arthracosis; ulceration into the esophagus due to breaking down arthracotic lymph node.

that fact, we have the same degree of fibrosis and the same lymphatic blocking of both the spaces and the nodes, with a statistical record for mortality due to acute respiratory affliction which is considerably above that of the surrounding non-mining area. Reviewing the cases which we have observed at the Buffalo City Hospital, we find that we were in accord with these statements insofar as acute respiratory diseases are concerned, but that we differ where the incidence of tuberculosis is concerned, our studies pointing to an alliance between anthracosis and tuberculosis which cannot be denied (Fig. 17).

DIAGNOSIS

The various forms of pneumonoconiosis do not give pathognomonic pictures, and while X-ray examination is not essential to a proper diagnosis, such examination, coupled with a complete and careful history of the case, will make for a greater accuracy of diagnosis.

Radiograms will, however, give us no inkling as to the kind of dust inhaled, nor will they differentiate between the causes of fibrosis, except by the process of elimination. For instance, in an uncomplicated case of pneumonoconiosis, the X-ray will show increased linear markings which are diffuse, bilateral, symmetrical and extend out to the periphery, with corresponding increased glandular changes at the hila. Cases of cardiac disease, tuberculosis, syphilis, influenza, pneumonia and other respiratory infections will result in these changes, but the consideration of the clinical findings and history will lead to correct interpretation.

CONCLUSIONS

The doors to a solution of the problem of the hazards of the dusty occupation have been closed for over four hundred years. Little or no interest was taken in this menace to the worker's life. Even the medical profession seemed indifferent.

But, within the past few years, a new interest has developed in this field. Roentgenologists and other specialists are, many of them, beginning to devote a considerable portion of their time to the study of the problem. Labor unions have risen to voice their protests, and are demanding better protection from dust hazards, and the Government is backing their demand. The New York State Department of Labor has just finished its Ninth Annual Industrial Safety

Fig. 25. Ulceration of arthracotic lymph node into esophagus; quill passed through the opening.

Congress, held at Syracuse, where the Department of Labor made a display of 59 samples of industrial dusts, known to be productive of pulmonary fibrosis. This is an example of the present thought and interest in this field. One year ago there was an effort to pass a bill making silicosis compensable. England has such a law at the present time, and bases the compensation on the percentage of silica present in the dust.

While these things, individually, are of little moment, taken collectively, they exemplify the new interest in fibrosis; an interest which, I believe, will mark the coming of a new era of safety and security for the workers in these occupations.

REFERENCES

1. TICE: Practice of Medicine, Vol. V, p. 541.
2. COPLIN, W. M. LATE: Manual of Pathology, 5th edition, p. 548.
3. LANZA: Public Health Reports, XXXV, No. 1, pp. 5-6.
4. HOLMES, PAUL M.: Public Health Reports, XXXV, No. 1, pp. 5-6.
5. WINSLOW, C. E. A., and GREENBURG, LEONARD: United States Public Health Service Reprint No. 616, p. 5.
6. WINSLOW, C. E. A.: Jour. Am. Med. Assn., LXXXV, p. 348.
7. JARVIS, D. C.: Am. Jour. Roentgenol. and Rad. Ther., VIII, p. 248.
8. CLARK and SIMMONS: Jour. Indus. Hygiene, VII, p. 347.
9. WINSLOW, C. E. A.: Jour. Am. Med. Assn., LXXXV, p. 970.

PNEUMOPERITONEUM IN GYNECOLOGY[1]

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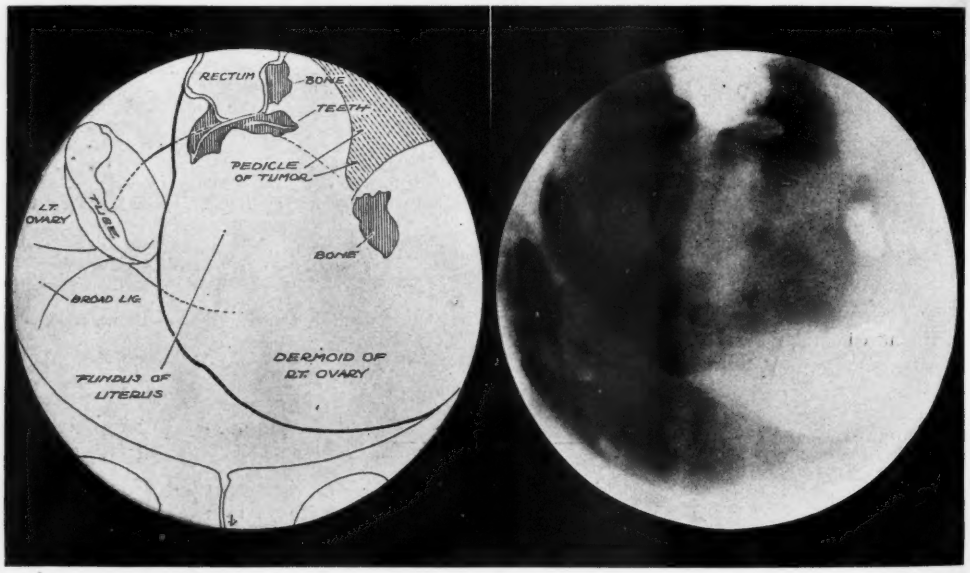
IT is our desire to bring before this Society the results of our study of the practical utilization of roentgenography for diagnosis in gynecology. This method, quite obviously, includes the induction of pneumoperitoneum. The soft structures, the uterus, tubes and ovaries, which otherwise are not distinguishable on the roentgen films, become readily visible when surrounded by air or gas. It is needless before this group of students of roentgenologic methods, many of whom are noted exponents of the method, to recall the history and development of pneumoperitoneum. We pay homage, moreover, to Orndoff, Stein and Stewart, Alvarez, and Sante for their contributions in this field; to Rubin for opening up the gateway of the transuterine route, and to Peterson and Van Zwaluwenburg for the development of the latter for abdominal inflation and for the introduction of the partial knee-chest posture when taking the films after inflation.

Following the method of Peterson and his associates, modifying it slightly with the addition of the Potter-Bucky diaphragm, we have induced pneumoperitoneum in over 160 patients for the purpose of establishing pelvic diagnosis. Both the transuterine and transabdominal routes were employed, using CO_2 through a Rubin patency apparatus. An ordinary lumbar puncture needle is used in the transabdominal method.

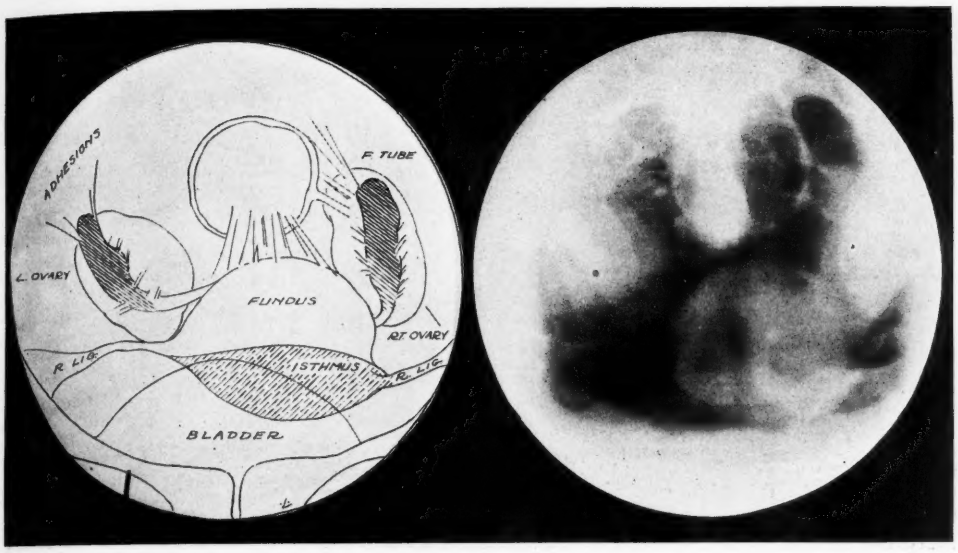


Figs. 1 A (diagram) and 1 B. Dermoid tumor of the ovary; teeth and bone shown in tumor. Uterus faintly visible behind. Transabdominal pneumoperitoneum.

For the purpose of clinical demonstration we have grouped a series of our cases as follows:

I. *Metrorrhagia.*—A group of four cases in which bleeding was the prime fea-

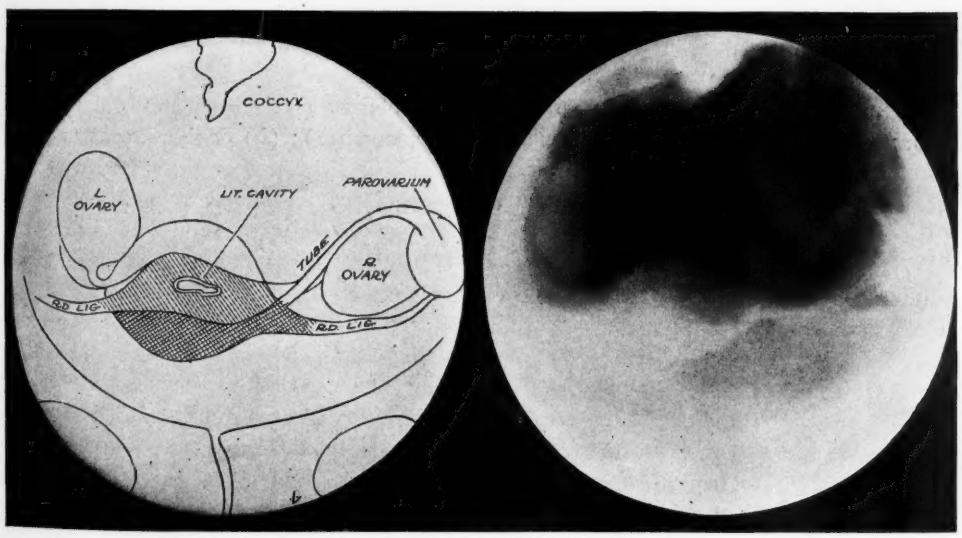
[1]From the Adolf Stein Memorial for Research in Roentgenology. Read before the Radiological Society of North America, at Cleveland, December, 1925.



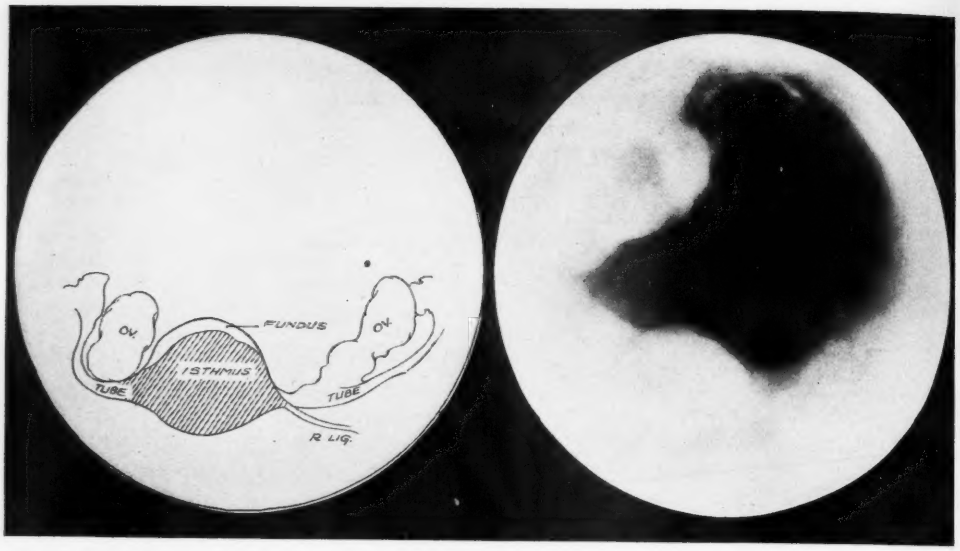
Figs. 2A (diagram) and 2B. Obstructed fallopian tubes, peritubal and ovarian adhesions. Transabdominal pneumoperitoneum.

ture, and in which the history and physical findings were either misleading or of little positive value. This included (*a*) fibroid of the uterus, (*b*) ectopic pregnancy, (*c*) small fibroids and retained ovular tissue, (*d*) double papillary cyst-adenocarcinoma of the ovaries. The roentgenograms in each instance clearly depicted definite pelvic pathology, rendering them of positive diagnostic value.

II. *Pregnancy.*—(*a*) A film depicting pregnancy at 8 weeks, and, in contrast, (*b*)



Figs. 3A (diagram) and 3B. Sterility eight years. Patent fallopian tubes. Normal genital status. Transuterine pneumoperitoneum.



Figs. 4 A (diagram) and 4 B. Primary sterility. Patent fallopian tubes. Hypoplastic uterus. Transuterine pneumoperitoneum.

a film of the normal pelvic organs of a girl 13 years of age in whom pregnancy had been suspected.

III. *Ovarian cysts.*—A group of five cases in which there was a divided opinion as to diagnosis, the film in each instance serving as the deciding factor: (*a*) a recurrent post-operative cyst; (*b*) double ovarian cysts, also post-operative; (*c*) a large dermoid which was readily identified by the presence of teeth and bone in the tumor; (*d*) a small follicular cyst associated with menstrual irregularity; (*e*) a rare "spontaneously disappearing cyst" (lutein) of the ovary.

IV. *Pelvic inflammatory conditions.*—Four cases demanding verification before surgical treatment could be advised: (*a*) double chronic salpingitis with adhesions and retroflexed uterus; (*b*) tubes obstructed by peritubal and ovarian adhesions; (*c*) tubo-ovarian abscess with adhesions to the rectum; (*d*) "frozen pelvis" of inflammatory origin. The pathological changes were shown so convincingly in the films that no doubt remained as to the necessity for surgical treatment.

V. *Sterility.*—Five cases, in three of which the tubes were patent and the normal pelvic status corroborated; one revealed a small polycystic ovary, and one depicted a hypoplastic uterus—primary sterility. The transuterine route was utilized in this group where tubal patency was in question.

VI. *Mal-developed uteri.*—(*a*) Bicornuate uterus (girl 14 years old, intense dysmenorrhea); (*b*) double uterus (patient sent to the gynecological service with the diagnosis of an ectopic pregnancy). The films were definitely diagnostic.

Without going into the detail of these cases, suffice it to say that a higher degree of accuracy in diagnosis is obtained by this method than is possible with the usual gynecological examination. While not advised as a routine procedure, pneumoperitoneum may often be utilized to settle differences of opinion which arise so frequently among gynecologists. The method entails no danger to the patient, and there is only transient

discomfort (160 cases without accident). As a *matter of record,* as in our cases of the disappearing ovarian cyst, the non-gravid uterus of a girl suspected of pregnancy, of deformed uteri, etc., the roentgen film is of inestimable value.

CONCLUSIONS

1. Pelvic pathology can be clearly and definitely shown by diagnostic pneumoperitoneum.
2. A direct and also a differential diagnosis of ovarian tumors may be thus established.
3. The film may prove the deciding factor where there is a difference in opinion.
4. As a matter of record the films may be of inestimable value, as in our cases of disappearing ovarian cyst, deformed uteri, and the non-gravid uterus of a girl suspected of pregnancy.
5. As a matter of legal evidence the films may prove to be of great value, whether positive or negative, both to the patient and to the physician.

DISCUSSION

Dr. Jacques Forestier (Aix-les-Bains, France): I wish, first, to express my thanks to Dr. Stein for the very fine slides which he has shown us; I speak frankly when I tell him that they are the best of the pelvis with pneumoperitoneum I have ever seen.

It seems to me that, after this very good paper, there may be some interest in discussing the relative value of the use of pneumoperitoneum and intra-uterine injections of lipiodol for the examination of the female genital organs. The instances in which this radiologic examination may be of interest to the surgeon are: First, in the case of a tumor or mass that may have been detected by palpation of the pelvis; second, in a case of sterility; third, during an early period of pregnancy. For the masses which are palpable in the pelvis, it seems to me that the value of the method varies with different conditions. All the changes in the uterine cavity may be clearly defined by the intra-uterine injection of lipiodol. On the contrary, all growth and changes outside the body of the uterus, extending into the pelvis, will be much better outlined by pneumoperitoneum. In a case of sterility and for a test of the patency of the fallopian tubes, it seems to me that the use of lipiodol is of greater value, because, when you make the injection of air into the uterus, you can tell only if the air is going through or not; by the injection of lipiodol you can see that quite well, but you can see more: at the same time you can see whether one or two tubes are open, and, in case of obstruction, you can localize it exactly for the surgeon.

For the early diagnosis of pregnancy, I cannot say that I quite approve the experiments which have been made in Argentine with lipiodol, but it seems to me that it is not much more dangerous to use an intra-uterine injection of lipiodol than to make a pneumoperitoneum. In most cases there is some chance of producing a miscarriage. Dr. Heuser has tried to make the early diagnosis of pregnancy by intra-uterine injections of lipiodol, and it is quite easy to make this diagnosis when you suspect such a case: you have a negative shadow in the uterine cavity which is given by the ovum.

In conclusion, I think that roentgenology is to be more and more a great help to the surgeon in making diagnoses of abdominal infections and tumors. I heard a sentence a few days ago, spoken by a distinguished French surgeon, in which he said that when he found something in the pelvis by palpation he was able in some cases to make a real diagnosis, "But in many cases," he added, "I know that there is something, and the operation will tell me what it is." I think by these two methods we can do more than that. In Argentine, they, especially Heuser,

Carelli, Ocampo, and Gandolpho, have made the two examinations together—I mean on the same patient—an intra-uterine injection of lipiodol and, at the same time, a pneumoperitoneum. They are able to make diagnoses, because they can see the uterine cavity as well as the outer shape of the uterus.

Dr. L. R. Sante (St. Louis): Just a few words in discussion of Dr. Stein's paper, concerning which I must certainly compliment him on his beautiful work. Our work with pneumoperitoneum has led us to understand and fully appreciate its usefulness, and we are still using it in examination of the abdominal organs. It is done according to the routine technic that we have established, and consumes no more than fifteen minutes. We have done over a thousand pneumoperitoneums and have not had a serious accident. I will briefly outline the technic we use in pneumoperitoneums, which I feel is as nearly fool-proof as any which can possibly be devised. We choose a point one inch to the left of the umbilicus, and insert a needle in the left lower quadrant. The needle is inserted without any previous anesthesia of the skin. The area is cleaned up with iodine and alcohol, the needle is grasped as you would grasp an awl, and with a slight rotary motion it is inserted through the skin. The second step is to elevate the needle to a position perpendicular with the abdomen; with the index finger on the end of the needle and the little finger guiding the needle so that it does not plunge, constant steady pressure is exerted in this direction, perpendicular to the abdominal wall. You feel the needle give way twice: first, as it goes through the fascia, and, second, as it goes through the peritoneum. Withdraw the stilet and allow the needle to remain a minute or two, then connect up to the rest of the apparatus, consisting of a piece of rubber hose connected to a pump—a little glass trap is interposed to prevent the introduction of anything like oil or foreign material. Then, listening on some remote portion of the abdomen, you can hear the inrush of the air with every stroke of the pump. If you get this characteristic sound, you can be positive that you are in the abdominal cavity; if you do not, you can be positive that you are not in. If you inject two or three times in the tissue, it makes no difference; all you do is to reinsert the stilet in the needle and try again. We have had no difficulty, and, except those done by myself, there have not been more than two or three done by any one individual. The intern makes the injection under our direction, and we have had no unfavorable results at all.

I want to say a word with reference to the diagnostic aid. I do not think you are going to attain proficiency in diagnosing from the pneumoperitoneum film from only an occasional use of the method. The interpretation of pelvic peritoneum films requires the most intimate knowledge of the pathology found in this region. I do not believe any radiologist who has not this intimate knowledge of the conditions that are met with in the pelvis by the gynecologist should attempt this diagnosis by himself; it should always be in collaboration with a gynecologist and after the most careful consideration of all points at issue and of what they have found. That it does give us a wonderful insight into conditions that may occur, I think there is no gainsaying. We all recall the wonderful work of Dr. Van Zwaluwenburg and Dr. Peterson on pneumoperitoneum and their communications on this subject, and I am sure that their technic can hardly be excelled.

Dr. B. H. Orndoff (Chicago): It is evident that with pneumoperitoneum the X-rays can be utilized in the diagnosis of pelvic conditions in such a manner as to give increased reliability in the determination of the character of disease in this field. It is evident, also, that, with such aids in

diagnosis, reasonable accuracy is provided for the general practitioner when he refers a case where such work is being conducted. It is difficult to understand just what effect on the general trend of medical practice these developments may initiate.

Cases with large abdominal tumor masses are sometimes very difficult to differentiate, especially if the problem is one of myofibroma or pregnancy. On several occasions I have utilized the peritoneoscope along with pneumoperitoneum and X-rays. In a small number of cases these methods, combined, do not serve to produce a positive diagnosis. Under peritoneoscopic direction, I have needled these tumors with long intra-spinal needles. The resistance of a tumor mass would certainly not be mistaken for the pregnant uterus. In addition, amniotic fluid can be withdrawn for diagnosis. Further, I have injected oxygen into the uterus and with X-rays observed the movements of the live child above the level of the amniotic fluid. We have had no undesirable complications or symptoms which we could attribute to this method.

I believe that after pneumoperitoneum, the X-rays and the peritoneoscope, together with other features of diagnosis in connection with them, offer a distinct field of diagnosis for which there is an essential demand.

RADIO-ACTIVE SUBSTANCES: THEIR THERAPEUTIC USES AND APPLICATIONS

TREATMENT OF LINGUAL CANCER BY RADIATION

By JOSEPH MUIR, M.D., New York City

CANCER of the tongue is clinically the most important of all buccal malignancies. Its incidence is somewhat greater than that of lip cancer, and it appears that causative factors such as are generally conceded to produce malignant lesions upon the lip, are still more actively operative within the mouth, while in addition other possible sources of irritation are present there, exposing the tongue to a greater variety of injuries than is likely to be found outside.

Regarding etiology, much the same can be said as has already been cited in discussing other buccal malignancies. There is every reason to believe that trauma, slight but long and persistent, is chiefly responsible for the appearance of the lesion in this particular location, and, as is the case with lip cancer, it is probable that the use of tobacco plays an important part in causation. In addition, jagged or broken teeth, improperly fitting artificial dentures, and other mechanical agents are very likely to abrade the tongue. To quote Bloodgood: "Tobacco, rough and dirty teeth, and improperly fitting plates predominate as causes of cancer of the tongue." In the case of tobacco we have not only mechanical irritation from burns or a pipe stem held against the lingual surface, but also the chemical action of the drug itself, so that it is not surprising to find that in more than 90 per cent of the tongue cancer cases there is a long history of the use of tobacco, usually in excess.

Many writers have noted the coincidence of malignancy of the tongue and buccal syphilis; indeed, this has so frequently been recorded as to give strong presumptive evidence that there is a definite relationship between the two, although the data so far gathered are too meager to permit any positive conclusions to be drawn from them. It seems reasonable, however, that the preexistence of condyloma latum would offer a fertile area for the growth of malignant cells, and the prevalence of tongue cancer would very likely be greatly lessened if particular attention were given to treatment of these mucous patches in the mouth, and patients so afflicted were kept under observation when they reached the age at which malignancy is prone to occur.

Though we have Scriptural authority that the tongue is "a little member," it is nevertheless subject to several varieties and locations of neoplasms. In clinical practice we usually speak of three areas where such lesions may be located: upon the forward dorsal surface, especially the "tip" or edge; upon the posterior dorsal surface, commonly designated as the "root," and less frequently under the tongue, or directly upon the floor of the mouth. As the first area named is the most prominent, and probably also the most likely to be subjected to trauma, malignant growths upon the tip have received more attention than any others, and these, also, are the only ones which have proved amenable to surgery. If such a growth is readily accessible, and is brought to the surgeon's attention early enough, complete excision often effects a cure. The chief drawback to surgical success is, however, the fact that such excision is seldom possible before glandular metastasis has taken place, for so early do the submental and submaxillary glands receive malignant implants from the original lingual lesion, that while the tongue cancer is still small and unalarming to the patient, a rapid extension of the disease will have taken place.

This tendency toward early metastasis makes the treatment of lingual cancer far more complicated than would otherwise be the case, for no matter what means we invoke to combat the disease, the state of the cervical glands must invariably be investigated with scrupulous care, and the conditions found dealt with intelligently; otherwise, the most skillful treatment of the primary lesion is likely to prove worse than useless.

Because its application has been necessarily limited to the forward part of the tongue alone, and also because it can seldom be applied before glandular extension has taken place, surgery has never been a satisfactory or adequate means of curing tongue cancer, and as soon as electric coagulation and, later, radiation were put forward as alternatives in the treatment of malignancy, therapists eagerly availed themselves of these means. But although the results in many instances were good, on the whole the outcome of all kinds of treatment has been far from satisfactory, and there is a very general desire for a better and more exact therapy, which will do away with the many disadvantages which have always attended the treatment of tongue cancer, and permit the same accuracy and elimination of "guess work" which is now possible in handling certain types of growths in other parts of the body.

Buried radium emanation has, thus far, come the nearest to fulfilling these requirements. Régaud, at the Radium Institute in Paris, and the staff at the Memorial Hospital, in our own country, have successfully treated large series of malignant tongue lesions by this means, and there is general agreement that intratumoral radiation is a vast improvement over any form of surface application. But the methods of implantation heretofore used have not been above criticism, and radium therapists everywhere have exerted themselves to improve them and thereby make a corresponding improvement in the record of permanent cures obtained in this way.

In lesions upon the forward dorsal surface it has been possible to embed needles, thus affording platinum filtration which obviated necrosis. But the proper immobilization of needles upon the surface of the tongue is an extremely difficult matter, and when the lesion lies at the root, or underneath, their employment becomes wholly out of the question. Bare tube implantation has done good work in certain types of lingual malignancies, but the inevitable necrosis which results from any bare tube implantation is a very grave drawback to this method. Also, these applicators are wholly unsuited for treatment of the attendant glandular lesions, which must, in the majority of cases, share the therapist's attention from the outset of treatment. Radium has heretofore found little favor as a means of reducing glandular malignancy, X-ray being a much more practical and satisfactory agent for that purpose. Régaud also uses X-ray in malignant lesions situated at the root of the tongue, though he states frankly that it is at best a very unsatisfactory means of dealing with this manifestation of the disease. The chief advantage which X-ray holds over needling is the elimination of the trauma incident to the placement of needles in those areas upon the tongue likely to be attacked by malignant growths, and the possibility of its application where it is wholly impossible to place a needle, or to keep it in position after it has been inserted.

The whole question of trauma looms very large when dealing with malignancy of the tongue, and in working out a technic which will get around all the difficulties heretofore encountered, special attention has been paid to this factor. The applicator by which radium is brought in contact with the affected area must be of such a nature as to disturb the tissues—both healthy and diseased—as

little as possible, which means in particular that it must be extremely small, readily inserted and just as easily withdrawn. Yet, it must likewise be capable of containing sufficient radio-active material to give off enough radiation from each center so that the entire mass of malignant tissue can be reached by the rays emanating from a small number of centers, as the fewer applicators we put in and take out again, the less we shall disturb the tongue tissue itself.

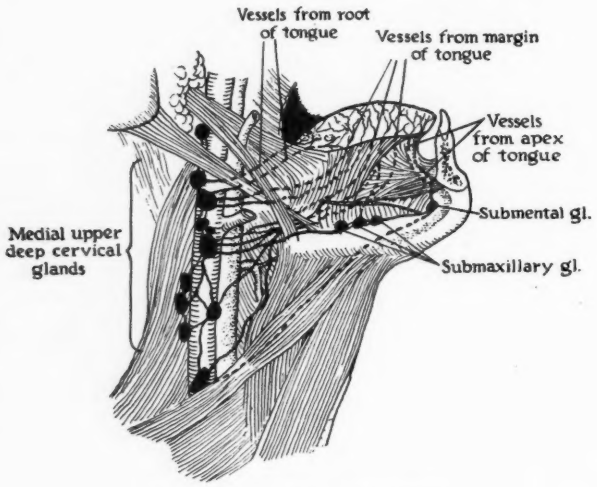


Fig. 1. Lymphatics of the tongue.

Again, the avoidance of necrosis is of the utmost importance, for anatomically the tongue is so located that any poisons generated there are even more deleterious to the organism than is usually the case, and the ready drainage from the tongue to the submental and submaxillary glands provides a route for the dissemination of toxins which is very likely to prove fatal even to patients who are clinically "cured" of the primary lesion.

By implantation of an applicator filtered with platinum, we are able to avoid all danger of necrosis. By making this applicator exceedingly thin and small, and placing it with an instrument especially designed to drive it home with a minimum of trauma to the tissues, we can overcome another major objection to intratumoral radiation in tongue lesions. And finally, by providing a means by which the applicator can be taken out as soon as it has given a sufficient exposure to gamma radiation to insure the sterilization of the tissues under treatment, we can meet all the objections hitherto made to using radium in the therapy of lingual cancer. All these *desiderata* are included in platinum-radon seed implantation.

The way in which this "seed" is prevented from inducing necrosis has already been described several times, but for the sake of clearness it may be well to recapitulate briefly. The experiments of Lacassagne showed that if a thickness of 0.3 mm. of platinum were used to filter different amounts of radio-activity which were then exposed to living tissue for twelve-day periods, so long as the contained amount of radio-activity did not exceed 7 millicuries, no necrosis resulted. To obviate any chance of greater radiosensitivity in individual patients, the

amount should always be kept considerably below this maximum, and in my own work I have, therefore, always limited the contained emanation in each seed to a value of 2.5 mc. only. Comparing this with the amounts previously considered safe when using bare tubes, it will be seen that we are permitted to employ about five times what has been possible with the older method of implantation, which makes it necessary to use a much more restricted number of radium containers than under previous conditions, this again lessening the chances of trauma to the tissues.

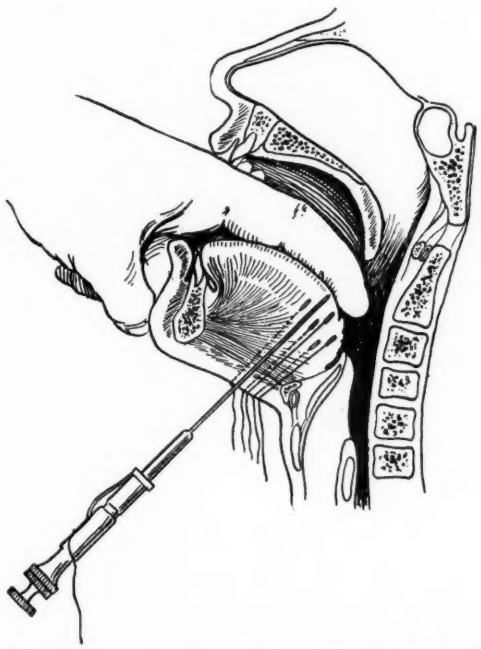


Fig. 2. Diagrammatic section of the tongue, showing the implantation of the removable platinum-radon seeds.

An absolute prerequisite to successful implantation is a correct estimate of the size of the lesion before any of the seeds are placed. When this has been made, the precise number of containers required can be readily decided, and each one can be so placed as to permit the gamma rays emanating from this center to affect the tissues on every side equally. Such an estimate can be made no matter where the growth is located, although it is naturally more difficult when it is placed very far back upon the lingual surface. In general, three to six 2½ mc. seeds will be enough to give a tongue cancer full and adequate radiation, the amount being regulated by the length of time the containers are permitted to remain *in situ*.

When the therapist is equipped with the proper implement for placing the seeds, implantation becomes a very simple matter. Indeed, it can even be done by one man alone, although trained assistance is naturally desirable whenever it can be commanded. The size of the lesion having been ascertained, the point of insertion of each seed should be determined so that when placed and giving off gamma radiation in all directions not only all the malignant tissue which

is in evidence will be not more than one centimeter from the radio-active center, but the surrounding zone of apparently unaffected tissue, which is, however, potentially malignant and should invariably be subjected to the effects of the therapeutic rays, will also receive dosage sufficient to effect sterilization of any possible extension of the malignant process.

When the seed is placed in its desired position the implanter is withdrawn, and the thread attached to the seed is left protruding from the point of entrance, being cut off to a length just sufficient to permit its being grasped with forceps for removal at the proper time. One centimeter is an ample length for this, yet is so short that its presence upon the surface of the tongue causes the patient no inconvenience.

The whole procedure is exceedingly simple, yet so effective and thorough in its results that it offers a new hope for those afflicted with this peculiarly malignant neoplasm. In dealing with glandular metastasis, while X-ray is still much favored both for its ready applicability and its good effects, the removable platinum-radon seed offers great possibilities. The fact that the implantations can be made from the outside with a minimum of trauma and resultant scarring, renders this procedure especially desirable. The possibilities of handling metastasis to the glands by radium applications are only just beginning to be realized; the field is as yet practically unexplored, and the near future promises to make known vast advances in this especial form of therapy.

REFERENCES

BAINBRIDGE, W. S.: Cancer of the tongue. Jour. Am. Med. Assn., 79:1480, October 28, 1922.

BLOODGOOD, J. C.: Cancer of the tongue, a preventable disease. Jour. Am. Med. Assn., 77:220 and 1381, July 16 and October 29, 1921.

LACASSAGNE, A.: Researches experimentales sur l'action des rayonments beta et gamma de radium agissant dans les tissus par radiopuncture. Jour. de Radiol., 5:160, April, 1921.

LARKIN, A. J.: Radium needles in malignant growths of the tongue: the time factor. Am. Jour. Roentgenol. and Rad. Ther., 10:734, September, 1923.

MUIR, JOSEPH: Technic of the use of removable radon seeds in carcinoma of the tongue. Ann. Surg., 83:598, May, 1926.

QUICK, DOUGLAS: Carcinoma of the tongue. Radium Report of the Memorial Hospital. 2nd Ser., 1923, P. B. Hoeber, New York.

REGAUD, C.: Le cancer de la langue; principes de son traitement par les radiations. Paris méd., 11:265, 1921.

IDEM: Sur la curiethérapie des épithèliomas de la langue et de leurs adénopathies secondaires. Paris méd., 15:296, October 10, 1925.

SIMPSON, F. E.: Carcinoma of the tongue treated by embedded glass ampoules containing radium emanation. Chicago Med. Rec., January, 1923.

TAUSSIG, LAURENCE: Carcinoma of the tongue and its treatment with radium. Arch. Dermat. and Syph., 6:424, 1923.

THE CONDITION CALLED PERTHES' DISEASE

By E. G. C. WILLIAMS, M.D., DANVILLE, ILLINOIS

"PERTHES' disease" has been the accepted name to apply to the group of non-tuberculous or non-inflammatory changes in the upper end of the femur that occur before union of the proximal epiphysis. The descriptive name of osteochondritis deformans juvenalis cannot apply unless the "itis" suffix can be replaced by some other term, for these cases do not show any symptoms of the inflammation suggested by the "itis."

Trophic diseases of other bones will not be considered in this discussion, as this is a very definite group with certain persistent symptoms and a very definite importance in differentiation from hip joint tuberculosis. The etiology is indefinite. No one has offered anything definite. Possibilities are: Nutritional disturbance, calcium deficiency, embryonic malformation. The symptoms can best be given as a hypothetical or composite case history.

Composite case.—A school child under fifteen years, slightly under weight but apparently healthy and active, develops a tenderness in the hip joint region and a limp. After a few days' rest he appears to be all right and returns to school, but has a more severe attack after a few weeks. Examination shows a shortening of the leg. There is no fever, no swelling, and very little pain. Radiological examination shows beginning flattening of the head of the femur, with separation of the epiphysis and upward displacement of the neck. There is no evidence of erosion or destruction of bone. The acetabulum is not involved.

It must be emphasized that the traditional symptoms of tuberculosis of the hip joint are absent. There is no fever, no swelling, and only slight pain. In the absence of these classical symptoms the diagnosis of tuberculosis cannot be made.

Lack of understanding of this group has placed most of the cases in the tuberculosis class, and it is among these that we see the rapid cures of hip joint tuberculosis. We feel that any man who thinks he has cured a case of hip joint tuberculosis with six or eight weeks of immobilization has been mistaken in his diagnosis and has cured a case of Perthes' disease.

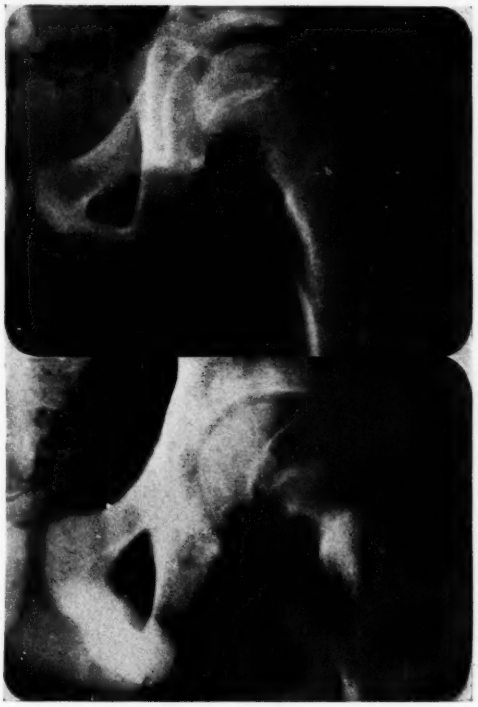


Fig. 1 (above). Case 1.
Fig. 2 (below). Case 2.

After a few weeks of rest and immobilization the patient is again able to be out and is apparently well with the exception of a limp due to the shortening. Injuries to the joint may loosen the callus and cause repeated slight attacks.

The adult who gives such a history usually presents himself for X-ray examination

because of pain resulting from injury to the hip region. Examination shows a short, thickened femoral neck, flattened head, and a compensatory flattening of the acetabulum. There is no ankylosis.

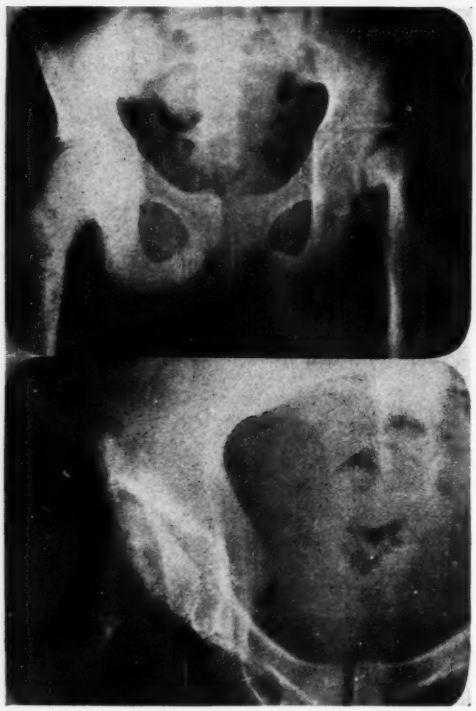


Fig. 3 (above). Case 3.
Fig. 4 (below). Case 4.

The five cases presented might well be successive stages of the same case. The histories are almost parallel, showing absence of fever, only slight pain, no definite swelling, no prostration, and only partial disability. Recoveries were complete, with the exception of some shortening and limp.

Case 1 (11223). Boy, aged 14, developed limp. No history of trauma. Radiological examination showed loss of lime salts and beginning flattening of upper margin of the head of the femur. About December 1, 1923, the hip was placed in a plaster dressing, but the patient was in a wheel chair throughout the day. No extension was used. After four weeks the dressing was removed and a few days later crutches were discarded. He was sent back to school and shows only a limp as a result of his experience.

Fig. 5. Case 5.

Case 2 (15335). Boy, aged 12. History of repeated attacks of tenderness and limping. No trauma. No fever nor swelling. Radiological examination showed separation of epiphysis, with upward displacement of neck about two centimeters. Bone changes were distal to the epiphyseal line. Two centimeters shortening and a slight lameness were the only symptoms that remained after a few weeks' rest.

Case 3 (15147). Boy, 12 years old. Repeated attacks of tenderness and limping. Became very lame on account of shortening. No fever, no swelling, only moderate amount of pain. The hip was immobilized with plaster for eight weeks, after which the patient was given crutches. These were soon discarded and only a slight limp remains.

Case 4 (16027). Man, age 30. History of lameness during childhood, without fever or other evidence of infection. Never in bed on account of hip. Trouble was called rheumatism and no definite treatment was given. Has been bothered by shortening and some limitation of motion. Two weeks before presenting himself for examination

he was riding a railway motor speeder. A train stopped in front of his speeder and he tried to stop by putting his foot against the rear of the train. The jar caused him some pain and increased his lameness. He presented himself for radiological examination because of suspected fracture. No fracture was found. The neck of the femur is short and thick. The head is flattened and the acetabulum conforms to the shape of the head. After two weeks' rest he returned to work.

Case 5 (Courtesy of Dr. L. H. Dunham). Man, aged 65. Has had attacks of tenderness in hip since early childhood. Was never bedfast because of this trouble. No history of fever or swelling. Affected side shows shortening of three centimeters. Presents himself for examination because of attack of pain. The neck of the femur is short and broad, the head is distorted and flattened. The acetabulum conforms to the shape of the femoral head. There is limitation of motion but no ankylosis.

The absence of the usual symptoms of tuberculosis permits the conclusion that these cases are not tuberculous and no definite proof has been offered that there is any inflammatory process present.

CONCLUSIONS

Many of the instances of very rapid cures of "tuberculous hip joint disease" that we have seen or heard of where not cases of tuberculosis.

Before putting a hip joint case in extension or plaster for an indefinite period be sure that it is tuberculosis.

In the absence of fever, swelling and pain a diagnosis of tuberculosis should be questioned.

The descriptive name "osteochondrodystrophy-juvenalis" is offered to replace "Perthes' disease" and the inaccurate "osteochondritis deformans juvenalis," which suggests inflammation where none exists.

BARIUM PLASTER X-RAY PROTECTIVE WALLS FOR ROENTGEN LABORATORIES[1]

By H. N. BEETS, M.S., Physicist, Michael Reese Hospital, CHICAGO, ILLINOIS

THE subject of protective walls is of interest to all who are planning new or revamping old laboratories. Investigation shows that the ordinary tile-and-plaster wall so widely used in building construction is not adequate protection against X-rays produced at radiographic or therapeutic voltages, when the tube is in an open lead glass bowl, in the size of room that is ordinarily allotted to X-ray purposes. It is true that such walls can be covered with lead to give any desired protection, and there is no better protection than this method can afford, provided the lead has a sufficient thickness and is properly laid. In fact, any other wall materials should be compared to lead as a standard.

The use of barium plaster has been advocated as an X-ray protective wall material (1) (2) (3). Available information regarding the value of barium plaster walls is conflicting. Inasmuch as we were preparing to build a new laboratory it was decided to make some comparative tests as to the relative value of barium walls and lead walls. Several samples of barium plaster walls were made and tested. Only one type proved successful, this plaster being made of one part barium sulphate, one part Portland cement, and two parts of barium sulphate sand (crushed barium rock).

Photographic tests were made of sections of wall of varying thickness using the barium plaster described above. The tests were made as follows: a section of wall and a lead echelon with uniform steps were laid side by side on the same film (film enclosed in Eastman cardboard holder) and exposed to the X-rays. In this way the tests were independent of exposure times, fluctuating milliamperage or voltage, photographic emulsion, developer temperatures, etc. The results of the tests were as follows: less than ½ inch of barium plaster fails to act as a homogeneous filter and cannot be said to have a lead equivalent; ¾ inch barium plaster is equivalent at radiographic voltages (8 inch gap) to approximately 1/16th inch metallic lead; at therapeutic voltages (200 kilovolts) 2 inches of barium plaster, weighing 30 pounds to the square foot, is equivalent to approximately 5/32ds inch of metallic lead. The protective coefficient, the ratio of the lead equivalent thickness to the thickness of the barium wall, is in the first case 0.083 and in the second case 0.078, apparently constant for the two voltages. Hunt (2), for a somewhat similar type of plaster, reports protective coefficients for these voltages of 0.126 and 0.09, respectively. Dr. L. R. Sante (3) has reported on this type of wall, on the basis of ionization tests, as follows: 2½ inches of plaster is equivalent at 200 kilovolts to approximately ¼ inch lead, protective coefficient 0.1. Neither Sante nor Hunt gives the weight per square foot of the samples reported.[2]

The thickness of barium wall or lead necessary for adequate protection depends, as shown by Mutscheller (4), on the number of hours per day the tube is active, the milliamperage and gap used, and the size of the room insofar as this determines the distance between the operator and tube. Mutscheller estimates the tolerance dose for the operator to be one one-hundredth of an erythema dose per month. We do not be-

[1]From the Department of Radiology and the Otto Baer Fund for Clinical Research of the Michael Reese Hospital.

[2]A variation of ± 3 per cent has been noted in the weights of various slabs made from the same mix, after thorough drying, that cannot be explained entirely on the basis of irregularity in the contour of the slabs. It is possible that one sample may be more porous than another.

lieve this estimate to be too high, and for the purposes of this paper will accept it.

By means of Mutscheller's equations and tables (4) we can calculate what, under certain definite conditions, constitutes adequate protection. (*A*) A radiographic room 12 × 14 feet, operating 30 days per month, in which 100 exposures per day are made using an 8 inch gap, X-rays of 0.17 Å. wave length, 40 milliamperes, 5 second exposures, with a distance of 6 feet from the operator to the tube—the required thickness of lead to protect the operator adequately is 1.9 mm., approximately 5/64ths inch. The barium plaster equivalent is 15/16ths inch.

(*B*) A radiographic room 12 × 15 feet, operating 25 days per month, in which 100 exposures per day are made at 6 inch gap, 40 milliamperes, ½ second exposures, X-rays of 0.2 Å. wave length, and a distance of 6 feet from operator to tube—the required lead protection is 0.8 mm., or 1/32d inch, The calculated barium plaster equivalent is a ⅜ths inch thickness, but ⅜ths inch of plaster is not satisfactory protection because of non-homogeneity. If the plaster is laid ⅜ths inch thick on each side of the wall the total thickness, ¾ths inch, will act as a homogeneous protection and should be the minimum of plaster used in any case.

(*C*) A treatment room of the same dimensions using 200 kilovolts, X-rays of 0.12 Å. wave length, 6 milliamperes, operating 8 hours per day, 30 days per month—the calculated thickness of lead required for adequate protection is 5 mm., or 13/64ths of an inch. The equivalent barium plaster would be a layer 2½ inches thick.

(*D*) The same room operating 4 hours per day, 25 days per month, at 200 K.V., 6 ma., average wave length of X-rays 0.14 Å., 6 feet from tube to operator—the thickness of lead required for adequate protection is 3.4 mm., approximately ⅛th inch, the barium plaster equivalent being a total thickness of 1¾ths inches.

The conditions assumed in cases (*A*) and (*C*) are extremes; (*B*) and (*D*) are perhaps average. Laboratories doing a lesser amount of work in larger rooms can be adequately protected with less lead or barium plaster. In no case, however, should less than ¾ths inch total of plaster be used. The thickness of lead required for any given operating conditions can be calculated by the same formulæ.

We wish to thank the National Pigment Company and the Dick X-ray Company, both of St. Louis, for the raw materials and the directions for making the barium plaster.

REFERENCES

1. Barclay, A. E.: Archives of Radiology and Electrotherapy, January, 1923.
2. Hunt, F. L.: American Journal of Roentgenology and Radium Therapy, Dec., 1925, p. 524 *et seq.*
3. Sante, L. R.: American Journal of Roentgenology and Radium Therapy, April, 1925, pp. 383, 384.
4. Mutscheller, A.: American Journal of Roentgenology and Radium Therapy, Jan., 1925, p. 65 *et seq.*

CASE REPORTS

DIAPHRAGMATIC HERNIA: CASE REPORT

By N. J. NESSA, M.D.,

Sioux Falls Medical and Surgical Clinic
SIOUX FALLS, SOUTH DAKOTA

Patient, Mrs. E. F. O., 65 years of age, weight 165 pounds, occupation, housewife, was referred by Dr. O. Charles Erickson, June 26, 1923.

History.—During the past ten years or more she has had vague distress in the epigastrium following meals. She describes the pain as being dull, gnawing, and radiating to the left and back while in the upright position, the same being less persistent while in the reclining position. Some sour stomach; gas; no history of jaundice; vomits occasionally a few hours after meals, showing the presence of bile. Weight stationary, appetite good. No history of any injury during life period. Some anemia—blood shows reds 2,000,000, hemoglobin 45 per cent. Urine negative.

X-ray examination by barium meal reveals the following: Stomach shows clearance in six hours. Barium enters the stomach at a point below the diaphragm and fills up the pars cardiaca, and then passes through a narrow opening into a portion of the stomach above the first portion, apparently located above the diaphragm, and then returns to a point near the spine, where it enters the duodenal bulb.

Diagnosis.—Diaphragmatic hernia, probably congenital.

The referring Doctor has informed me within the last six months that the patient was still living and well. The anemia was apparently of secondary origin and not incidental to the hernia.

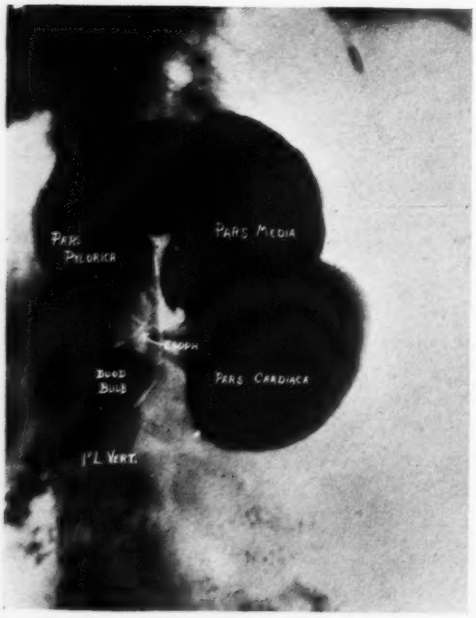


Fig. 1. Case of diaphragmatic hernia, probably congenital.

GASTRIC ULCER DEMONSTRATED BY THE GAS-FILLED STOMACH: CASE REPORT

By EDWARD N. McKEE, M.D., Methodist Hospital, LOS ANGELES, CALIFORNIA

The patient was an unmarried female, aged 23, who entered the hospital February 7, 1926, with a temperature of 105.6° and the following chief complaints: Headache; abdominal pain; lumbar pain; vaccination on right thigh.

Patient felt ill on the day preceding her entry to the hospital, had severe back pains and complained that "all her bones felt as if they would break." Vomited several times before entering hospital; vomitus after entering was of greenish hue. Had abdominal pain and epigastric tenderness, but no diarrhea. No jaundice, no cough nor

dyspnea since day of entrance, when back pain seemed to cause difficult respiration.

Physical Examination. — (Abdomen) Slight area of distention in epigastrium, with regional tenderness. The lower abdomen was quite spastic; no tenderness; no marked rigidity. Tender area over region of stomach and pancreas. (Extremities) Vaccination area on right thigh.

PROGRESS RECORD

February 8: Reaction from vaccination can account for all symptoms.

February 10: Epigastric tenderness and some muscle spasm in this region. Vaccination not causing symptoms now, and evidence of pathology in upper abdomen quite marked.

February 11: Pain and tenderness in upper abdomen suggestive of acute pancreatitis. Tenderness most marked on left side of abdomen near costal margin and area of left kidney. Impression is that of general blood infection, possibly from vaccination, but could be from other focus.

February 12: Chest clear, no râles; heart regular, rapid, no irregular sounds; extreme tenderness left kidney and spleen area; nausea produced by turning on right side.

February 13: Left kidney area distinctly more swollen and tender, more marked than any other portion of the abdomen; right kidney area soft; twelfth rib easily felt; left rib cannot be felt. Advise X-ray of this area.

X-RAY FINDINGS

The radiograph showed both kidneys normal in size and position, with no evidence of calculus. Patient was much worse on the two following days and a radiograph of the epigastric region, including the upper border of both diaphragms, was made; this was the examination that showed up the gas-filled stomach. The X-ray work was done by portable as it was impossible to move the patient.

The X-ray report of the epigastric region is as follows: "This shadow includes both diaphragms and extends down to the fourth

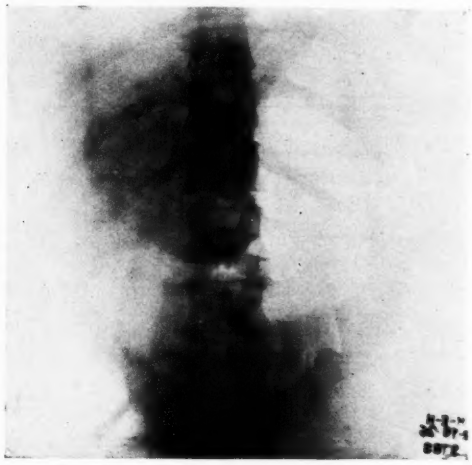


Fig. 1. Radiograph from which diagnosis was made. Taken with portable apparatus.

lumbar. The diaphragms are apparently normal. There is a calculus about the size of a French pea, in the region of the pelvis of the right kidney. The stomach is well outlined, being markedly distended with gas. Pylorus is well up under the right costal margin, while the cardiac portion is pressing the left diaphragm. Underneath this we find a heavily outlined gas-filled transverse colon, showing in both the hepatic and splenic flexures. There is an irregular break in the outline of the stomach on its greater curvature, at about the juncture of the cardiac and antral portions. Whether this indicates an old gastric ulcer or not, we are unable positively to say, but the incisuræ are very prominent."

DIAGNOSIS

Probable perforating gastric ulcer. Immediately after the X-ray report the patient was operated upon and the following report

made of the surgical findings: "Both right and left kidneys normal in size, shape, consistency and location. Duodenum, gall bladder and liver apparently normal. Transverse colon visualized, and found normal. Pancreas was felt, not enlarged. Enlarged lymphatic glands around the lesser curvature of the stomach, and a distinct ulcer on the lesser curvature of the stomach, with some yellowish exudate sealing over its surface. There was a thin watery fluid in this area, but no evidence of fat necrosis. Upon introducing the finger into the foramen of Winslow a number of cobwebby adhesions were felt."

Post-operative findings. Ruptured gastric ulcer on lesser curvature of stomach.

Immediate post-operative condition. Excellent. Patient semi-conscious when leaving the table. Uneventful recovery.

The remarkable point in this case is that the diagnosis was made entirely from a gas-filled stomach (Fig. 1).

Another case, that of a young man about 24 years of age, was found the following week with acute pain in the epigastric region. Endeavoring to rule out a possible kidney condition, the X-ray plate revealed a very large gas-filled stomach, with marked incisuræ and evidence of gastric ulcer. The patient was operated on immediately and a perforating ulcer was found, confirming the X-ray findings.

In the writer's experience have occurred only a few well defined gas shadows that would indicate pathology, outside of pneumoperitoneum work. He would be glad to have other members of the Society comment on this case.

EDITORIAL

ROENTGEN-RAY TREATMENT OF BONE TUMORS

The treatment of bone tumors, benign and malignant, up to the last few years has been almost entirely by surgery. Treatment by radiation, radium and roentgen ray, particularly the latter since the advent of the high voltage roentgen ray, is becoming gradually more and more frequent. In the literature, case reports of encouraging results within the last few years should stimulate the use of this method more frequently, with a careful following-up of each case. It is, of course, too early to base definite conclusions, since not enough time has elapsed for positive cures. A histologic study in each case of a bone tumor to be treated with the roentgen ray is desirable, but is not always feasible. When exploring a bone tumor, particularly a sarcoma, one should be prepared either to do a wide resection, amputation or cauterization. Exploration stimulates metastasis and this is more likely to be avoided by radiation than by biopsy. It is also well to caution that unless one has had experience in the roentgen-ray interpretation of bone lesions, particularly neoplasmata, and experience in the technic of using the high voltage roentgen ray, much harm may be done. Both central and periosteal sarcomata not infrequently metastasize to the lungs and mediastinum, and it is advisable in these cases to treat over the chest prophylactically. One of the first symptoms noted in the treatment of sarcoma is relief of pain. This symptom is often an excellent indicator whether to continue treatment or not. It has been found that those cases which are apt to respond best to treatment and which have the best prognosis are those which obtain relief almost immediately or within a period varying from a few days to two or three weeks. The effect on the tumor itself and the surrounding infiltration is rapid. There is regression of the swelling and regression of the tumor, as is manifested by lessening in size of the bony growth, which assumes a more or less smooth appearance. The quicker there is relief from pain and the quicker there is regression of the soft structure tumor and bony growth, the more hopeful one can be that the immediate effects are apt to be followed by healing and possible cure. On the contrary, if pain persists or is even aggravated and there is no regression of either the soft structures or bony tumor after several treatments through different portals of entry, the prognosis is not so good. These cases are best treated surgically, amputation offering relief of pain, and with an artificial limb the patient may live in comparative comfort for some months or possibly years.

Surgery has been followed by cures in a very small percentage of cases in the malignant tumors. This method has been and will continue to be the choice of treatment where it is definitely indicated, and since practically nothing is lost in treating with the high voltage roentgen ray, it seems worth while to treat these cases first by radiation. Even hopeless looking tumors sometimes respond with gratifying results.

The diagnosis is to be based on a careful history, physical examination, laboratory examinations, including a study for the

presence or absence of Bence-Jones bodies, Wassermann test, and particularly roentgenograms. It is always well to roentgenograph the corresponding part for comparison, and especially to roentgenograph the chest. The chest should be studied routinely in every case of bone tumor.

It is, of course, advisable to differentiate the types of bone tumor, and, what is even more important, to know that the patient has a bone tumor before starting treatment. The myxoma particularly appears to be resistant to roentgen-ray treatment and is best treated surgically. There is little or no relief from pain, with slight effect on the growth. Errors of this kind are to be avoided and it is well to remember that ossifying periostitis, osteomyelitis, tuberculosis and syphilis may and often do simulate a bone tumor. These, however, are not influenced—or only slightly so—by the roentgen ray, and much valuable time may be lost if its use is continued before proper treatment is instituted. Carcinomatous metastasis appears to respond well to the roentgen ray. Not only is pain relieved or greatly reduced, but the bone undergoes osteoplastic changes. Destruction is not infrequently stopped and the destroyed bone is replaced by new bone and recalcification takes place. The treatment should be continued at intervals of three to six months. In this way the patient may live in comparative comfort for several years. Not only the bones involved, but the entire skeleton should be treated in these cases.

Of the benign bone tumors, the giant-cell tumor appears to have responded well to the roentgen ray. In contradistinction to some of the malignant tumors, pain and swelling of the soft structures are very apt to be increased at first in the giant-cell tumor, which may persist for from four to six weeks. About this time both begin to subside and roentgenograms at this period reveal recalcification, with more or less solidification of the bone shell, with a tendency toward healing. A number of cases of cures have been reported. In time, with more experience, it is very probable that bone neoplasmata, properly selected, will be treated as frequently as other neoplasmata, and that the roentgen ray will offer as much and probably more toward palliation and cure than surgery.

MAX KAHN, M.D.

THE MILWAUKEE MEETING

THE COMMERCIAL EXHIBIT

The Commercial Exhibits at the coming meeting of the Radiological Society at Milwaukee will be conducted along the same general lines as were the exhibits at Cleveland, Kansas City, Atlantic City and previous meetings.

It has at no time been the purpose of the manager of this exhibit to collect more money from the exhibitors than would pay the expense of the meeting, and we have tried to make the rental rates equitable with the advantages of the space, and as low as possible. Firms in all parts of this country have received the blueprints and letters the same day and have had equal chances for the most desirable space. The result of this has been that the space is usually all rented weeks before the meeting and frequently emergency or additional space has had to be provided for late comers.

We feel that a large exhibit, where all the leading manufacturers of and dealers in apparatus and accessories show their lines, is of enormous educational value to all who attend the meeting and view the exhibits. Of course, the exhibitors receive a great deal of good advertising and are in a position to spread their propaganda and literature among *real buyers*, as well as meet "face to face" with many old customers and prospective new ones. It is with this idea in

mind, rather than with the purpose of securing the greatest financial return for the funds of the Society, that we have continued to conduct this exhibit. We feel that the members who have seen the exhibits have received their part of the dividends, and, from the reports of exhibitors, they are well satisfied. *All the money collected goes to the Society.*

It will be the purpose of those in charge of the exhibits at Milwaukee to see that the attention of all attending the meeting is called to the Commercial Exhibits. The exhibits will be located in the Auditorium, where all the meetings are to be held. The space arranged for is more advantageous and desirable than at any previous meeting. The attendance is going to be the largest ever in the history of radiology and the Commercial Exhibit will be featured and accorded the important place that is its due. Notices and announcements at various times and places will call the attention of all attending to the Commercial Exhibits. Watch for them.

Blueprints and literature announcing the particulars will be in the hands of the prospective exhibitors at an early date.—*Dr. I. S. Trostler, 812 Marshall Field Annex, Chicago, Manager of Commercial Exhibits and Transportation, the Radiological Society of North America.*

TROSTLER ON TRANSPORTATION

SPECIAL RAILROAD RATES HAVE BEEN GRANTED

One and one-half fare for the round trip on the certificate plan, from all points in the United States and eastern Canada, will be in effect for the Twelfth Annual Meeting of the Radiological Society in Milwaukee, Nov. 29 to Dec. 4, 1926, inclusive. The Western Canada Passenger Association is the only association to refuse to grant the reduced rate. Members from this region may take advantage of the rate by buying local tickets to the nearest station in the United States, and from that point buying tickets for Milwaukee and getting the convention CERTIFICATE, which will enable them to buy return tickets to the last buying station for half fare. It is altogether likely that there will be a special rate to Chicago from western Canada at that time, and it may be possible to save a considerable amount by taking advantage of it. This should be inquired into before buying tickets.

All who attend this meeting, including the wives and families, should secure CERTIFICATES when buying tickets for Milwaukee. These CERTIFICATES should be deposited with the railroad clerk at the registration desk at the meeting place (the Auditorium). After these CERTIFICATES have been signed by me for the Society, they will be validated by the representative for the railroads—if 250 have been presented—and should then be reclaimed by the owners. These validated CERTIFICATES will then be good for one-half fare returning to the place where issued, over the same route.

Announcements will be made from time to time during the meetings relative to this. Watch for them. Ask your local railroad agent for particulars.

The Plankinton Hotel has been selected for headquarters, and Dr. A. R. Altenhofen, of Milwaukee, Wis., is Chairman of the Hotel Committee.

I. S. TROSTLER, M.D.

INFORMATION CONCERNING MILWAUKEE HOTELS

The committees furthering the plans for the Twelfth Annual Meeting of the Society, to be held at Milwaukee, November 29 to December 4, inclusive, have collected and here offer information concerning the city's hotels and their rates.

Astor Hotel. Juneau Avenue and Astor Street. In residence district, and new.

The Lounge, Plankinton Hotel.

Apartment hotel, European plan. Mr. Hall, Manager. Telephone, Broadway 5500.

Single room, with bath	$5.00 per day.
Double room, with bath	9.00 per day.
Parlor, bedroom, and bath (3 or 4 persons)	25.00 per day.

Hotel Martin. Wisconsin and Van Buren Streets. Mr. J. Clark, Manager. Telephone, Broadway 4200.

Single room, without bath	$1.50 to 3.00 per day.
Single room, with bath	2.50 up per day.
Double room, without bath	2.50 to 5.00 per day.
Double room, with bath	3.50 up per day.
Double room, with bath (twin beds)	5.00 per day.

No suites.

Hotel Medford. Third and Sycamore Streets. Mr. J. S. Reid, Manager. Telephone, Grand 5420.

Single room, with toilet	$2.25 per day.
Double room, with toilet	3.25 per day.
Single room, with bath	2.50, 2.75, 3.00 per day.
Double room, with bath	3.50, 3.75, 4.50 per day.
Room with twin beds, without bath	3.50 per day.
Room with twin beds, with bath	5.00, 5.50 per day.

No suites.

Hotel Pfister. Wisconsin and Jefferson Streets. Mr. Ray Smith, Manager.

Single room, without bath	$2.50 and up per day.
Single room, with bath	3.50 and up per day.
Double room, without bath (double bed)	4.00 and up per day.
Double room, with bath (double bed)	5.00 and up per day.
Double room, with bath (twin beds)	7.00 and up per day.
Parlor rooms	8.00 and up per day.

Plankinton Hotel. Headquarters of the Radiological Society of North America, Twelfth Annual Meeting. West Water and Sycamore Streets, in heart of theatrical and retail district, convenient to depots, easy walking distance from Auditorium. Parking space for two hundred cars adjoins the hotel. Sky Room, cafe, and Toastie Sandwich Shop. The Plankinton Hotel, with the Hotel Anthony and the Hotel Keenan, of Fort Wayne, Indiana, and the Hotel Waldorf, of Toledo, Ohio, belong to the Keenan Hotel System. Mr. Walter Keenan, Manager.

Single room, with bath	$3.00 and up per day.
Double room, with bath	5.50 and up per day.
Double room, with bath (twin beds)	7.00, 8.00, 9.00 per day.
Parlor, bedroom, and bath, 1 person	15.00 and up per day.
Parlor, bedroom, and bath, 2 persons	15.00 and up per day.
Parlor, bedroom, and bath, 3 persons	20.00 and up per day.

Plaza Hotel. Martin and Cass Streets. New apartment hotel, European plan. Mr. J. Riebs, Manager. Telephone, Broadway 7080.

Single room, with bath	$3.00 per day.
Double room, with bath	4.00 per day.
Parlor, bedroom, and bath (single)	3.50 per day.
Parlor, bedroom, and bath (double)	5.00 per day.

Republican House. Third and Cedar Streets. European plan. Mr. Albert Paul, Manager. Telephone, Grand 4822. Lo-

cated a block and a half from the Auditorium. This is one of the older hotels, with a reputation for serving excellent food. Its cafeteria, open from 7 in the morning until midnight, serves 1,500 persons daily. In the cafe the prices are: luncheon, 65 cents; dinner, 85 cents.

Single room, without bath	$2.00 to 3.00 per day.
Single room, with bath	3.00 to 5.00 per day.
Double room, without bath	3.50 to 5.00 per day.
Double room, with bath	5.00 to 8.00 per day.
Twin beds, no extra charge.	
Parlor, bedroom, and bath, 3 persons	15.00 and up per day.

Hotel Wisconsin. Third Street, near Grand Avenue. Mr. E. L. Kill, Manager. Telephone, Grand 4900.

Single room, without bath	$2.00, 2.50, 3.00 per day.
Double room, without bath	3.50, 4.00, 5.00 per day.
Single room, with bath	3.00, 3.50, 4.00, 5.00 per day.
Double room, with bath	5.00, 6.00, 7.00 per day.
Double room, without bath (twin beds)	5.00, 6.00 per day.
Double room, with bath (twin beds)	7.00, 8.00 per day.
Two rooms, with connecting bath, 4 persons	10.00, 12.00, 15.00 per day.

Naturally, all intending to attend the meeting at Milwaukee will do well to make reservations early.

The Milwaukee Auditorium is located near—but not in—the heart of the downtown district. Every downtown car line discharges passengers within two blocks of its door. Automobiles approach it by an uncongested highway. Parking space is available in a building especially erected for this purpose; also in plot occupied by Milwaukee Tourist Welcome Bureau in the adjacent square.

Booths, electric power and light, gas, stage settings, decorations, structural frame-

The Sky Room, Plankinton Hotel.

works—practically anything that may be required for exhibition purposes—is provided by the Auditorium. The costs are measured by cost systems, and exhibitors are charged for their requirements in accordance with these costs.

PROTECTION AGAINST ROENTGEN RAYS[1]

A committee of the Council of Hygiene [of the Netherlands] has proposed regulations regarding protection against roentgen rays, not only of technicians but also of persons in the vicinity. The committee recommends governmental authorization for the establishment of a roentgenologic laboratory or for the modification of an existing laboratory. Furthermore, the medical use of roentgen rays should be permitted only to registered physicians. Roentgen rays should not be used otherwise except for certain scientific and technical purposes. Authorization for installation should be given only after an investigation as to the need of it. The committee took up also specialization in roentgenology. A special license for roentgenologists is advocated. The report deals, in several chapters, with the relative

[1]Reprinted by permission from the *Journal of the American Medical Association*, Aug. 7, 1926, p. 426.

value of various methods of protection against roentgen rays. The committee approves the establishment of a standard erythema dose.

Ethylene gas as an anesthetic is contraindicated in X-ray examinations on account of its explosiveness when mixed with more than 40 per cent oxygen or between 75 and 95 per cent air.—C. L. Hewer, in *British Journal of Anesthesia,* April, 1926, p. 174.

BOOK REVIEWS

CONTRIBUTION A L'ETUDE DES RADIONECROSES TARDIVES. By DR. ALBERT LA CHAPELE. A thesis based on work done at the Pasteur Laboratory of the Radium Institute of the University of Paris. Paper. Pp. 111, with 9 illustrations. Paris: Norbert Maloine, 1926.

This thesis represents a critical review and analysis of all cases of late radionecrosis reported in the literature and 26 other cases observed by the author himself and reported in detail in the thesis. The clinical manifestations of late radionecrosis, their mode of appearance, localization and evolution, are discussed. The technical conditions predisposing to them and other predisposing causes are analyzed; the determining causes and the mechanism by which such lesions are produced, their diagnosis, prophylaxis and treatment are mentioned in some detail. There is appended to the thesis a fairly complete bibliography of the subject. This thesis is invaluable to anyone wishing to study this subject, because it brings into a few pages a general review of the whole subject with a sane and sound critical discussion of all its phases.

A. U. DESJARDINS, M.D.

ROENTGEN INTERPRETATION. By GEORGE W. HOLMES, M.D., Roentgenologist to the Massachusetts General Hospital, and Assistant Professor of Roentgenology, Harvard Medical School; and Howard E. Ruggles, M.D., Roentgenologist to the University of California Hospital, and Clinical Professor of Roentgenology, University of California Medical School. Lea & Febiger, Philadelphia, 1926. Pp. 326. $5.00.

The revised third edition of this well known book on roentgenographic interpretation has been sufficiently enlarged to include the more recent developments in roentgenographic technic and interpretation. Two new chapters have been added, one on the spine, the other on fluoroscopic technic. The latter is especially valuable to the physician doing occasional X-ray work in his office.

Written by men of wide experience, the new edition, as well as the two preceding editions, is concise yet thorough, sufficiently conservative, and authentic.

The book is amply illustrated, the illustrations being selected to show, not only the typical lesions, but also to demonstrate the limitations of roentgenographic diagnosis. It should be in the hands of every physician interested in X-ray interpretation.

K. S. DAVIS, M.D.

PRECIS DE RADIOTHERAPIE PROFONDE. By I. SOLOMON, Radiologist of Saint-Antoine Hospital, Paris. With preface by A. BECLERE, Member of the Academy of Medicine. Paper. Price not mentioned. Pp. 512, with 174 illustrations. Paris: Masson & Co., 1926.

Heretofore, there has not been available any systematic treatise on radiotherapy. The present volume by Solomon is an attempt to provide such a treatise and this at-

tempt has been carried out with considerable success. The book, for which Dr. A. Béclère has provided the preface, deals with each branch of the subject in a semi-historical way and in this manner gives one a good background for the more recent work which, in general, is adequately dealt with. The arrangement of the subject matter is very good, the book being divided into two parts; the first part deals, in the order named, with the production and nature of roentgen rays, their physical and chemical properties, their biologic properties, qualitative measurement, quantitative measurement, tubes and kenotrons, high tension generators and their accessories, tube stands and means of protection. The last two chapters of the first portion deal with the bases of radiotherapy, principally the biological bases, and with the distribution of radiation in matter. The second portion takes up in a systematic way the action of radiation on different varieties of tumors, on tuberculous conditions, certain diseases of the nervous system, blood and blood-forming organs, the glands of internal secretion, and finally, miscellaneous diseases, such as gastric and duodenal ulcer, hypertrophy of the prostate, asthma, Mikulicz's disease, etc. Each variety of tumor or disease is discussed first from the clinical and pathological, and then from the radiological standpoint. Under the latter, reference is made to the ideas of different specialists (almost entirely Continental) on the question of technic.

This work is a distinctly worthy addition to radiotherapeutic literature. The discussions of the various subjects, especially in the first portion of the book, are generally very good. It is natural that the author, who has himself devised an ionization chamber for measuring X-rays—an instrument which has been generally adopted by French radiologists—should have a tendency to further his own instrument and the method based upon it. However, this tendency has been kept within reasonable bounds and has not prevented him from dealing fairly with other methods.

The second portion of the book, while generally sound, is perhaps not quite as good as the first portion. On reading it, one becomes conscious of several things, among which may be mentioned insufficient recognition of literature outside of France and Germany, a tendency to exaggerate slightly the claims advanced in favor of radiotherapy, and, here and there, evidence of unfamiliarity with recent advances in certain phases of clinical medicine, notably on the subject of hyperthyroidism.

The title of the book itself is unfortunate in that it tends to consecrate an expression which should be discouraged. The word "deep" should have been omitted, and yet, after reading the book, one can understand its inclusion, because Solomon belongs to the group of radiologists who favor the use of X-rays generated at high voltage in the treatment of most conditions amenable to radiotherapy. Another deficiency is the form in which the bibliography is given, no index having been provided. That the well known action of radiotherapy on benign giant-cell tumors is not even mentioned was perhaps an oversight. On the whole, the book is a serious attempt to state in as fair a way as possible the present status of radiotherapy, except that portion which deals with the treatment of skin diseases, which is completely omitted. That the attempt has not been entirely successful is perhaps due to a tendency to overstress radiotherapy, thus throwing slightly out of focus the general balance of the work.

A. U. Desjardins, M.D.

ABSTRACTS OF CURRENT LITERATURE

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Studies in cancer growth.—It is evident that metastases in cancer are not the result of a simple migration of cancer cells from the cancer to distant organs; they are primarily the result of the spread of a liquid substance from the main tumor mass. This substance spreads over surfaces, and is liberated through a digestion of cells in the center of the mass of cancerous tissue,—a digestion which is not an autolysis resulting from the absence of oxygen, but the result of an excess of growth-stimulating substance, a product of the cell's oxidation. This fluid is rich in growth-stimulating substance: it stimulates not only the cancer cells to grow but also the normal cells. The cancer cells, already adapted to it, respond more quickly, in their growth removing the nutritive and necessary substances from the other ceils, destroying them.

This type of reaction may not always occur. As is well known, the normal tissue may undergo malignant transformation: such has been seen frequently in transplanted cancers of animals, such transformations being the results of a sufficiently long action of this fluid.

While these observations are interesting in throwing light on the nature of the mechanism of cancer metastases, their greater importance is the more absolute proof they give for the cause of cancer.

In 1920, when the author began to study the cause of cancer intensively at the Barnard Hospital, St. Louis, it had been shown that cancer could be induced by any one of a number of substances and conditions, such as coal tar, other lipoid solvents, bacteria, animal parasites, roentgen rays, radium, arsenic and other substances. In man as well as in animals it is a disease of old age and may occur not only through the action of any one of the substances mentioned in the foregoing, but also in congenital tumors and defects, in old chronic inflammatory areas, in tissues suffering atrophy from old age and tissues forced to atrophy from various external factors, such as exposure to sun and weather.

While animal experiments had shown definitely that any of the substances or conditions mentioned could induce cancer, they had also shown the same substances not to be concerned or necessary for the subsequent growth of this disease. Cancer, once induced by coal tar, grows indefinitely to the destruction of the host without any further additions of this substance. Many cancers induced by coal tar have been transplanted to other animals and have continued to grow as actively as ever, long after the tar has disappeared.

It became evident from these observations that cancer is not the result of any specific substances or group of substances. It is the result of some primary change either in the cell or the tissue which may be induced by any one of a number of widely different substances and conditions.

In view of the fact that no one has been able to show that the cancer cell is different from any other cell and that cells can grow in a tissue culture in a medium of the blood plasma of the body only when they are crowded in considerable numbers into a small amount of this medium which is well supplied with oxygen, the question arises, May not cancer be only the result of cell crowding and stagnation in the body?

To assume that cancer is the result of irritation and then the invasion of a parasite was not possible in the light of any known facts. It, therefore, became of interest to study the action of the various substances in inducing cancer. It was found that each acts only to induce the formation of a dense stagnant mass of cells having a reduced blood supply. Drops of coal tar produce such a tissue organization by attracting the fixed tissue cells to them and crowding them about their peripheries. Bacteria and animal parasites, when introduced into the tissues, stimulate the cells to proliferate without the formation of blood vessels and intercellular substances. Roentgen rays decrease the blood supply and also stimulate the cells.

The question that concerned the author was, therefore, whether metastasis as well as the independent growth of cells can be explained by the same cell crowding and stagnation. In previous work it has been noted that cells of large, densely cellular fragments can migrate along the surface of a medium independent of any specific absorbing substance in the medium. They accomplish this by the fact that a liquid is liberated from the centers of these larger fragments, a liquid which can flow over any water surface. The cells move into it. In this article it has been possible to show that such a fluid precedes the spread of cancer cells and metastases in the organism. It has thus been possible to give practically absolute proof for the foregoing deductions of the nature of cancer by showing that the whole phenomenon can be reduced by simply cutting down the blood supply to a cellular tissue and allowing the cells time to revert from the differentiated to the growing state.

L. R. SANTE, M.D.

The Mechanism of Cancer Metastasis. Montrose T. Burrows. Archiv. Int. Med., April, 1926, p. 453.

Substernal thyroids.—The term is limited to two classes of growths: (1) substernal, or abnormal descent of the main gland, a lobe or an adenoma; (2) intrathoracic goiter, or aberrant glands growing within the chest. In a series of 495 teleoroentgenograms taken in connection with cardiovascular examinations, six cases of substernal thyroid were found. Very frequently, substernal thyroids are diagnosed as aortic aneurysms. Symptoms fall into two groups: toxic symptoms due to hyperactivity of the gland, and pressure symptoms.

The definite positive demonstration of substernal thyroid is made by fluoroscope or radiograph. Even with the roentgen ray, errors are possible, the usual mistake being to call a substernal thyroid aortic aneurysm. Careful examination should prevent this. (The radiographs shown in connection with this paper show how easily substernal tumors could be mistaken for lesions of the aorta.) Seven cases are described.

W. W. WATKINS, M.D.

Substernal Thyroid. David Felberbaum and Benjamin Finesilver. Am. Jour. Med. Sci., February, 1926, p. 218.

Pre-operative X-ray therapy in inoperable uterine cancer.—The author reports several cases of inoperable cancer of the uterus which were subjected to X-ray therapy and later operated on, with evidently good results. He recommends giving this method a thorough trial. It is interesting to note that in 1914 Heimann carried out the same procedure in operable cases.

E. A. POHLE, M.D.

Operable and Inoperable Uterine Cancer after X-ray Therapy. H. Seidemann. Strahlentherapie, 1926, XXII, 554.

Evaluation of methods.—The tendency to consider cancer of the cervix exclusively a radiation proposition is decried. The importance of thorough physical examination, early diagnosis, diagnostic curettage, etc., is emphasized. Two cases are reported which had had both radiation and operative treatment, the former including both radium and X-ray, the latter consisting of panhysterectomy. One patient was well four years after operation; one died.

The author concludes that the question of choice of treatment is still undecided; that surgery is the treatment of choice in early and borderline cases of cancer of the fundus, and in early cases of cancer of the cervix; that radium is indicated in late lesions of the fundus and in borderline and late lesions of the cervix. The author is a surgeon.

CHARLES D. ENFIELD, M.D.

Surgery versus Radium in the Treatment of Cancer of the Uterus. James Y. Welborn. Cincinnati Jour. Med., April, 1926, p. 76.

Derangement of the ankle joint.—Dr. Prince discusses the importance of accurate reduction in fractures involving the ankle joint, particularly in reference to the complete restoration of the proper weight-bearing alignment. To permit union to take place with faulty weight-bearing alignment is to subject the patient to an additional crippling influence which may become a marked and painful permanent disability.

The diagnosis of fracture of the ankle joint is usually easy, but the pain and swelling may prevent a proper examination and exact classification of the type and extent of injury. The roentgen-ray examination is most valuable and should be made in all injuries about the ankle joint. Proper reduction and treatment depend upon our knowledge of the type and extent of the injury, and this information the X-ray gives. Also, the X-ray gives information as to the proper amount of bone to remove in the correction of old deformities following improper reduction of these fractures.

F. B. SHELDON, M.D.

Derangement of the Ankle Joint, Following Fractures of the Lower End of the Tibia and Fibula. Lionel D. Prince. Calif. and West. Med., July, 1926, p. 42.

To determine the age of a fracture by radiography.—The author thinks that it is possible to determine the age of a fracture by radiography, and cites an experience of 140 cases of fracture of different durations. He bases his estimations on the opacity, volume, and delimitation of the callus, on the character of the line of fracture, and on the reconstituted bony tissue. *In simple fractures of the shaft without displacement of the fragments* the first change noted is a blunting of the edges and of the bony spicules, which shows about the end of the second week. Callus begins to appear between the sixteenth and twentieth days; it is clearly delimited at the third or fourth month, and reaches the opacity of normal bone at the eighth or tenth month. In the first year the callus shows no lamellar structure. The line of fracture disappears between the sixth and eighth months to become more opaque later, in the second year. *In fractures with displacement* the callus does not become delimited until later,

about the sixth or seventh month, and it is not reduced so readily as in simple fracture without displacement. *In fractures of the fingers,* blunting of the edges is observed as early as the first week, and callus appears as a delicate white cloud between the second and third weeks; it becomes clearly defined at the end of the fourth month, and between the sixth and seventh months it reaches the opacity of normal bone.

Estimation of the Date of a Fracture. O. Andrei. Chir. d. org. di movimento, Bologna, Feb., 1926, p. 254. (Reprinted by permission from Brit. Med. Jour., June 19, 1926, p. 102 of Epitome of Current Medical Literature.)

Chronic non-tuberculous lower respiratory tract infection.—This condition is characterized by a sputum persistently negative for tubercle bacilli, but with various pus organisms frequently found; by chronic cough and expectoration; by varying grades of toxemia. The physical findings closely simulate those of occult tuberculosis, but the distribution of the signs is usually different, being rarely found in the apices. The heart rate is usually normal or even slow. Evening rise in temperature is not the rule. Exacerbations, *i.e.,* periods of acute lower respiratory tract infection, are common in the course and usual in the history of the disease. The tired feeling is not usually as continuous as in occult tuberculosis, but varies from day to day.

Roentgenologically, the condition is characterized by sharply outlined bronchial markings of greater than normal density in the middle and lower lung fields, with relatively normal apices. The trunks are not "beaded"; there is relatively little change in the peripheral markings. The presence of old and recent changes in the same chest would suggest tuberculosis, as would also calcification of old lesions, though apparently both these conditions may occur in non-tuberculous infections.

Bronchiectasis is a common late development in these cases, while pleural changes are uncommon. Autogenous vaccines are apt to cause marked improvement in both clinical picture and roentgen signs, or may produce a marked focal reaction in the lung.

CHARLES D. ENFIELD, M.D.

Non-tuberculous Peribronchitis Simulating Occult Tuberculosis. Charles N. Meader. Jour. Am. Med. Assn., July 17, 1926, p. 139.

The lymphatics.—This is a study "undertaken to determine whether or not there is a direct lymphatic connection between different parts of the abdomen and the biliary apparatus." The subject has become one of vital interest to those who are seeking the pathogenesis of cholecystitis, hepatitis, and allied conditions. After an exhaustive study of the literature, and experimentation, the author reaches the following conclusions:

"1. The lymphatics of the duodenum and gall bladder are intimately and directly connected.

"2. Some of the lymphatic vessels of the liver, gall bladder, duodenum, pancreas, and appendix enter the lymph glands which are located about the portal vein.

"3. The lymphatic connection of the liver and gall bladder is made in the parenchyma and capsule of the liver.

"4. Phenoltetrachlorphthalein is not normally secreted by the wall of the gall bladder, but it is secreted through the wall of the duodenum and of the jejunum."

The paper is accompanied by a copious bibliography.

The Lymphatics of the Extrahepatic Biliary Passages. Shuichi Kodama. Surg., Gynec. and Obst., August, 1926, p. 140.

Five types of osteomalacia.—Osteomalacia is a disease in which the bones become soft, bend and break easily, resulting in extreme deformities. It is extremely rare in children, most frequently occurring in women and usually associated with the puerperium. Five types are recognized.

1. Puerperal form. Occurs in women who have had numerous and frequent pregnancies. Calcium deposits in the fetus take place in the last three months of fetal life and deplete the mother's system of calcium. As a result, her bones become weak and brittle.

2. Non-puerperal form. Occurs with equal frequency in men and women: it is slow, progressive and does not affect pelvic bones especially.

3. Hunger osteomalacia. This form was most frequently observed in Germany during the post-war period. The cause is not exactly clear but it seems most probable that it is due to a perversion of the calcium metabolism. Some attribute the disease to lack of vitamins, others to deficient sunlight, etc.

4. Senile form. Occurring in old people and taking on the character of bone atrophy. Presumably a using-up of calcium salts without proportionate deposition. The process is mild and slow.

5. Juvenile osteomalacia. This form is quite rare and is usually found during adolescence. There is nothing to indicate that heredity plays a part. Two cases of the ju-

venile form are presented in detail in this paper. Mineral metabolism studies were made and showed deficiency. Numerous roentgenograms are reproduced showing the characteristics of the disease. Microscopic studies were made and minutely described.

L. R. SANTE, M.D.

Osteomalacia in Children: A Study of the Mineral Metabolism. Hugh L. Dwyer and Orren S. Eckelberry. Am. Jour. Dis. Child., May, 1926, p. 639.

Comparison of ultra-violet lamps.—The *Ra*-intensity (*Ra* from Rachitis=Rickets) of various ultra-violet lamps, *i.e.*, the ultra-violet radiation which is effective in the treatment of rickets and corresponds to the line 2,890–3,100 Ångströms has been compared by the author. He used a cadmium cell (Dorno) in connection with an electrometer (charge and discharge method). It appears that per kilowatt energy input the 220 volts A.C. mercury vapor lamp is the most efficient apparatus for producing "health promoting" ultra-violet rays; then follow the 110 volt D.C. mercury vapor lamp and the impregnated carbon arc lamp.

E. A. POHLE, M.D.

Intensity Measurements in the "Health Promoting" Part of Certain Ultra-violet Radiators. P. F. Dannmeyer. Strahlentherapie, 1926, XXII, 738.

Effect of roentgen rays on food.—Ludwig and Hopf have reported recently (Strahlentherapie, 1925, XX, 342, abstracted in RADIOLOGY, 1926, VI, 268) that serious pathological changes may be observed in mice and rats which are fed on irradiated food. The author undertook control series but was unable to confirm the before-mentioned findings. He explains the discrepancy with the different types of food used by Ludwig and Hopf, which evidently was insufficient to keep the animals alive.

E. A. POHLE, M.D.

Studies of the Effect of Roentgen Rays on Food. A. Czepa. Strahlentherapie, 1926, XXII, 764.

Method of catheterization.—The authors experienced difficulty in introducing a catheter up to a ureter that at first attempt permitted no passage. The patient was a female, aged 71, in a weak condition, in whom it was desired to arrive at a diagnosis as to the renal condition. It was found impossible to introduce the fluid for the roentgen examination. On the left side, cystoscopy was done, but on the right side the catheter could not be passed more than an inch beyond the orifice. With the catheter held in this position, 12 per cent sodium iodide solution was injected, and the roentgenogram thus obtained revealed that the ureter followed such a tortuous course that the introduction of the catheter was impossible. The right kidney was shown to be down in the pelvis, and the only hope of straightening the ureter sufficiently to allow the passage of the catheter to it, lay in elevating the pelvis of the patient and manipulating the kidney up farther in the abdomen. The authors were successful in accomplishing this measure, and the catheter was gently pushed past angulations to the neighborhood of the right kidney. A film was made which showed a pyonephrotic kidney on the right side, low down, and a tortuous ureter.

The authors conclude that the elevation of the pelvis and manipulation of the kidney to push it upward into the abdomen is a successful procedure in similar cases. The paper is illustrated.

Maneuver to Facilitate Passage of Catheter Through a Markedly Tortuous Ureter for Securing Roentgenograms. Bransford Lewis and Grayson Carroll. Jour. Am. Med. Assn., June 12, 1926, p. 1833.

The gall bladder.—After reviewing the conclusions of various writers concerning the function of the gall bladder, Remynse says: "It is in every way comprehensible that the question as to the significance of the gall bladder has come prominently forward, in accord with the extension and development of the surgery of the bile ducts. One of the principal arguments for or against cholecystectomy is closely connected with the significance to be ascribed to the gall bladder."

Animal experimentation has shown that the horse, rat, and peccary have no gall bladders, and pathological anatomists have discovered instances in which humans lacked a functioning organ. "In all other animals the gall bladder is present, and is in no sense a rudimentary organ as is the appendix. From this it is to be inferred that the function of the gall bladder is not unimportant. . . . . The way in which the gall bladder is connected with the liver differs in the different animals very much." Of animal experimentation in this matter the author says that it has done "but little to give us a clear view on the function of the gall bladder. This is not astonishing, because, in performing experiments on

animals, we create a pathological condition, and therefore we may not rely on the results so far as the uninjured gall bladder or bile ducts are concerned."

The author quotes Van Hengel (1912) and adds that "one thing of consequence," in accordance with Van Hengel's findings, is that the bile ducts enlarge when the gall bladder is removed. He continues: "Yet every surgeon knows that in the clinic this phenomenon reappears. Almost always we find distended bile ducts when the gall bladder has been put out of function."

Remynse discusses "the existence or nonexistence of the so-called sphincter of Oddi," the musculature of the gall bladder, and the conditions which control its enlargement. He reviews the experimental work of Rous and McMaster.

The conclusions reached are as follows: "The fact that removal of the gall bladder is not fatal may not be accepted as proof that the function of the gall bladder is not important. Of more significance is the manner in which the organism adapts itself to its loss."

The Physiological Significance of the Gall Bladder. J. G. Remynse. Surg., Gynec. and Obst., August, 1926, p. 181.

A rare condition complicating smallpox.—"A case of smallpox in a child presents a clinical picture of acute polyarticular arthritis, the symptoms in the arms having appeared shortly after the eruption and the involvement of other joints following rapidly. Roentgenographic examination revealed a symmetrical, widespread, destructive process at the epiphyseal line of the long bones, and in the first cervical vertebra, which became dislocated." The lesions were symmetrical. Recovery and repair were quite complete, but it is pointed out that if the epiphyseal lines close early (the patient was four years old), and if, as in the wrist and ankle, only one of two bones entering into a joint is involved, marked deformities may result. Such shortenings and deformities have been described in a series of cases collected by Chiari. The condition is quite rare.

CHARLES D. ENFIELD, M.D.

Osteomyelitis Variolosa: Report of a Case Observed during the Acute Stage. E. J. Huenekens and Leo G. Rigler. Jour. Am. Med. Assn., July 31, 1926, p. 295.

Iodized oil.—This is report of 27 cases of the use of iodized oil in the clinic of the Yale University School of Medicine. The history of its use is reviewed, beginning with Winternitz, who, in 1897, "described a method of preparing iodized oil using an animal fat." After animal experimentation he concluded that the iodine was absorbed from the gastro-intestinal tract. "Since that time," Neuswanger continues, "iodized oil has been used for the therapeutic effect of the iodine and has been given to both experimental animals and human subjects with no untoward results. Iodized oil at the present time is available under the commercial names of 'lipiodol,' 'iodoleine,' and 'iodipin 40 per cent.' The first preparation is a French product of carnation oil in chemical combination with iodine to the amount of 0.54 gram per cubic centimeter. The second is a very similar French product of poppy seed oil with approximately 30 per cent of iodine. The third is a German product of sesame oil in chemical combination with iodine to the amount of 0.51 gram per cubic centimeter."

To Forestier and Sicard he gives credit for having "first demonstrated the value of iodized oil as a contrast medium in roentgenography," the solution being reported as relatively impervious to the roentgen rays.

From the results of experiments on animals the author answers a series of questions, calculated to represent the problems presented to the roentgenologist by the use of iodized oil. Of the 27 clinical cases in which it was used by the author, 5 showed normal kidney and ureter, 1 double kidney, 1 "horseshoe kidney," 2 renal ptosis, 3 hydronephrosis, 4 ureteral stricture, 2 hypernephroma, 3 renal calculus, 2 ureteral kink, 1 renal infarct, 2 pyelitis, and 1 malignant papilloma of renal pelvis. Of his results in these cases the author says: "Satisfactory shadows of the iodized oil injections were obtained in every case, and in two instances when previous pyelograms and ureterograms with a 12.5 per cent solution of sodium iodide solution had failed to cast a shadow sufficient to make a diagnosis."

Following his statement that "iodized oil was found to be especially useful in obese patients," the author gives a number of case reports, together with reproductions of ureterograms, pyelograms, and drawings and photographs of pathological specimens.

He draws up the following conclusions:

"Iodized oil 40 per cent has no marked bactericidal or bacteriostatic properties.

"Iodized oil 40 per cent, injected intravenously in dogs in quantities three times those used for the average pyelogram and ureterogram, may produce areas of congestion and hemorrhage in the lungs without any permanent anatomical change, the animals

showing no symptoms of irritation or toxicity over a period of two months.

"Iodized oil 40 per cent may be used to inject the urinary tract in laboratory animals and patients without resulting symptoms of irritation or toxicity.

"This preparation appears to offer a pyelographic medium which is superior to those in use at the present time in regard to toxicity and degree of opacity to the roentgen ray."

Iodized Oil as a Pyelographic Medium: With a Report of 27 Cases. C. H. Neuswanger. Surg., Gynec. and Obst., August, 1926, p. 169.

Splenectomy.—This is a report upon 417 splenectomies performed at the Mayo Clinic from 1904 to 1926, for the following conditions: Disease of the spleen due to infection and toxic agents, 190; abnormality of the white blood cells, 50; abnormality of the red cells, 147; splenic neoplasm, 10; surgical accident, 10; indefinite and unclassified, 10. The mortality was 10 per cent.

In the first group were ten in which a greatly enlarged spleen was removed for chronic syphilis. With the exception of one death, all the patients were promptly relieved of all signs and symptoms of syphilis and the accompanying anemia and have remained in good health. In eight cases of tuberculous spleen, except for one death, all patients recovered and have remained well. Patients with septic splenomegaly did not show very encouraging results.

In the 50 cases of splenomyelogenous leukemia, it was found that if the spleen were first reduced by X-ray and radium, it could be removed without much risk. It was noticed in removing spleens that had been favorably influenced first by radiation that there was a marked change in the outer layers of the spleen in the form of a protective capsule around the active splenic substance. This may explain the limitation of radiation effects. In young persons in the early stages of splenomyelogenous leukemia and especially in atypical types, splenectomy is well worth consideration, and pre-operative reduction in size by radiation is advisable. In all these cases, except for two deaths, there was immediate reduction in the white cells. Some of the patients have been able to continue at work for more than five years, though in most cases the disease, after temporary improvement, pursued its usual fatal course.

In 62 cases of pernicious anemia, there were four deaths. Comparative statistics show that patients with splenectomy for pernicious anemia live two and a half times as long as those without splenectomy.

No patient should have the spleen removed for chronic disease when he is on the downgrade.

W. W. WATKINS, M.D.

The Mortality and End-results of Splenectomy. William J. Mayo. Am. Jour. Med. Sci., March, 1926, p. 313.

Etiology of diverticula.—Left lower quadrant pain, with nausea or vomiting, in the male predicates diverticulitis of the sigmoid, while in the female, in whom the disease is of relative infrequency compared to the male, the same situation of pain may mean any one of numerous diseases.

This article is based on 52 cases upon which operation was done.

From a review of the literature, diverticula are found to be about four times as frequent in men as in women; while most frequent in the sigmoid, they may occur at any place in the gastro-intestinal tract. The cause of these diverticula has not been definitely established, but it has been demonstrated that they occur in the weakest part of the gut near the blood vessel exits. They probably are herniations due to any excessive intra-intestinal pressure. In the natural processes of digestion they may fill and empty, giving rise to no symptoms. Occasion may arise where intestinal material becomes impacted and does not empty; infection may supervene and there may be abscess formation. The inflammation may resolve or may become chronic, and in a certain number of cases malignancy may develop. The X-ray is a great aid in making the diagnosis. Operative procedure has given good results.

L. R. SANTE, M.D.

Diverticulitis of the Colon. John F. Erdmann. Am. Jour. Obst. and Gynec., May, 1926, p. 609.

Multiple skin tumors.—A case of multiple skin tumors which appeared in a woman 52 years of age is reported in detail. The lesions, of about walnut size, were very painful, ulcerated, and scattered over the face, arms, chest, and thighs; they resembled a mycosis fungoides. Biopsy revealed a tumor-like tissue very suspicious of sarcoma. Continued roentgen-ray therapy (3.0 to 5.0 aluminum; 8–12H) led to complete cure. It was interesting to note that different lesions required different doses to heal; this is explained by their differ-

ent localization. The tendency to regenerate varies evidently in different parts of the body.

E. A. POHLE, M.D.

Roentgen Therapeutic Observations of a Peculiar Case of Multiple Skin Tumors of Sarcomatous Character. A. Czepa. Strahlentherapie, 1926, XXII, 709.

Morphology of cervix cancer and sensitivity to radiation.—A number of investigators have suggested a system of classifying carcinomata of the cervix. The author proposes to adopt the groups given by Schroeder: (1) undifferentiated immature cancer; (2) cancer with inclination to glandular differentiation; (3) typical adenocarcinoma; (4) half mature cancer with some inclination to basal cell formation; (5) carcinoma with definite basal cell differentiation; (6) cornifying basal cell carcinoma. Photomicrographs illustrate this system of classification. The distribution of the six types is as follows: Group One, 24 per cent; Group Two, 3½ per cent; Group Three, 4.7 per cent; Group Four, 41.5 per cent; Group Five, 26 per cent; Group Six, 10 per cent. Forty cases belonging to this class are reported. They were treated with 2,000–2,500 mgh. of radium followed by 90 to 115 per cent S.U.D. deep therapy radiation to the diseased parts.

The statistics show that the more differentiated types of cancer gave a better prognosis as to the therapeutic result of radiation. The use of the above mentioned grouping is recommended for a further study of the relation between sensitivity to radiation and morphology of the tumor.

E. A. POHLE, M.D.

The Morphology of Cervix Cancers as Basis for the Differentiation of Their Sensitivity to Radiation. R. Cordua. Strahlentherapie, XXII, 689.

Exophthalmic goiter.—Read bases this report on 100 cases of Graves' disease seen during the past six years. Too little attention has been paid to prognosis in the clinical reports of this condition. The most constant feature of the disease, and without which a diagnosis is never justified, is an elevated basal metabolic rate.

The first group contained 56 cases, 45 females and 11 males, with metabolic rates ranging from plus 22 to plus 112. There were six deaths in this group, four of them being of patients who were operated upon.

The second group comprised 19 patients, all mild and atypical cases. None had exophthalmos, but basal metabolic rates ranged from plus 13 to plus 65. There was one death in this group, a female with persistent hypertension.

The third group comprised 25 patients who had been operated on before coming under the observation of this author. They all presented some of the signs or symptoms for which the thyroidectomy had been performed. Their basal metabolic rates ranged from minus 7 to plus 80. This group illustrates what is not often brought out in clinical reports, that while thyroidectomy usually results in improvement, it very frequently fails to cure.

Of the 16 patients operated upon, five died as immediate result of operation. This author does not have any enthusiasm for surgery in exophthalmic goiter, partly because of its high mortality, and partly because it so often fails to bring the desired relief of symptoms. Of the 25 patients previously operated upon without the desired relief, eleven were subsequently treated by X-ray, with improvement in symptoms in eight.

In this author's series, 38 per cent seem to be cured and about 21 per cent are sufficiently improved to be restored to economic usefulness. The remaining 30 per cent, which includes 23 of the 25 patients previously operated upon, he considers to be diseased chronically, and to be unable to recover. He calls attention to the fact, so frequently overlooked, that, in about one-third of the cases of Graves' disease, the condition will be permanent whatever is done, and neither surgery, X-ray or medical régime will bring about more than temporary improvement.

W. W. WATKINS, M.D.

Prognosis in Exophthalmic Goiter. J. Marion Read. Am. Jour. Med. Sci., Feb., 1926, p. 227.

Foreign bodies.—The first case reported in this paper is one of a metallic foreign body in the esophagus for eight months. A three-year-old child began to have progressive difficulty in swallowing, especially in swallowing coarse foods: liquids or soft foods presented no difficulty. Six months after the beginning of trouble the tonsils and adenoids were removed. Soon after this, patient began to cough (no cyanosis), and was treated for bronchitis and asthma. At times, food was regurgitated. Two weeks later the patient had high fever, sore throat, cough, and dyspnea, accompanied by rapid loss of strength. The day before the child came under the writer's

observation, a metallic foreign body in the esophagus was discovered by X-ray examination.

The patient was anesthetized with ether and the upper end of the esophagus was examined with the laryngoscope, marked swelling and ulceration of the mucosa being noted. A small Jackson esophagoscope was passed through this ulcerated and swollen area until a foreign body was seen about one and a half inches below the upper end of the esophagus. It was so firmly embedded that some force was required to dislodge it. After its slow and careful removal, free bleeding occurred. Patient was returned to bed after fifteen minutes, in apparently good condition: fluids were given and the child seemed to swallow well. There was rapid improvement, and cough and dyspnea disappeared. When the patient left the hospital the parents were instructed to return with her in two weeks because of the possibility of stricture. She was not returned for examination for three months, when stricture of the esophagus was found to exist. The stricture was dilated every day for four or five days and the patient returned home with instructions to return in one month. The stricture has been dilated at intervals during the past few years and at present the patient is eating practically all kinds of food.

In the second case reported in this paper, the patient was an infant, three months of age, brought to the hospital with a diagnosis of laryngeal diphtheria, and a temperature of 103 degrees. X-ray examination revealed a large screw in the upper portion of the esophagus. Upon examination with a child-size Jackson laryngoscope, the screw was located and removed. There had been considerable pressure forward against the larynx and trachea by the foreign body, but after its removal the child made a rapid recovery with no respiratory symptoms.

B. C. CUSHWAY, M.D.

Foreign Bodies in Esophagus, with Respiratory Symptoms Complicating Diagnosis. J. B. Naftzger and T. R. Gittins. Laryngoscope, May, 1926, p. 370.

Roentgen treatment of exophthalmic goiter.—The author reviews the surgical-roentgenologic dispute as to the most efficient treatment for exophthalmic goiter and goes into the detailed aspect of complications associated with goiter. He calls attention to extensive surgical statistics of operative cases and meager roentgenographic knowledge. The paper is based on a follow-up study of 50 patients treated for exophthalmic goiter by roentgen rays.

He summarizes as follows: "Fifty patients with exophthalmic goiter have been carefully studied under roentgen-ray therapy. They were followed at frequent intervals during their course of treatment and subsequent to their recovery, with basal metabolism and clinical observations. Some have been followed for as long as five years. The great majority, 82 per cent, became entirely well and remained so. Of the remaining 18 per cent, 6 per cent were improved, 8 per cent were operated on, and 4 per cent were lost to the follow-up clinic during the last year, so that the ultimate result is doubtful.

"On the whole, the roentgen ray offers a safe and satisfactory therapeutic procedure, with a high percentage of cures, in cases of exophthalmic goiter."

L. R. SANTE, M.D.

Exophthalmic Goiter: A Follow-up Study of Cases Treated with the Roentgen Ray. Bertram J. Sanger. Archiv. of Int. Med., May, 1926, p. 627.

Post-operative laryngeal paralysis.—The authors introduce their paper on the treatment of this condition by saying: "The possibility of injury to the recurrent laryngeal nerve during operations on the thyroid gland has always been recognized, and to-day every surgeon uses well defined methods to prevent the occurrence of this most distressing condition. That the accident may occur, however, in the hands of the most experienced operators is frequently demonstrated; that it should occur much more frequently in operations performed by the 'occasional goiter surgeon' is not only true, but is altogether natural."

At the Thyroid Clinic of the University Hospital, Philadelphia, a routine laryngeal examination is made previous to operation. Paralysis of the recurrent laryngeal nerve is described, together with the palliative operative measures indicated. To Jackson and Tucker is given credit for an operation constructive in character, and whatever success it has had. "Without their co-operation in the frequent examination of the patients, we would be entirely unable to evaluate the results," the authors add. The operation in question, first suggested by Jackson and perfected technically by Frazier, consists in anastomosis of the proximal portion of one nerve to the peripheral portion of another. The authors' results indicate that "improvement is to be expected in at least 60 per cent of cases.

The incidence of improvement could probably be increased by confining the operation to patients in whom the duration of paralysis had not exceeded six years."

Treatment of Recurrent Laryngeal Nerve Paralysis by Nerve Anastomosis. Charles H. Frazier and W. Blair Mosser. Surg., Gynec. and Obst., August, 1926, p. 134.

Goiter in adolescence.—A report based on the study of 30 cases of exophthalmic goiter in children under fifteen years of age, the ages ranging from three years upward. Detailed reports of typical cases are given.

Tachycardia was present in 100 per cent, nervousness in 93 per cent, thyroid enlargement in 93 per cent, exophthalmos in 83 per cent, bruit in 70 per cent, and tremor in 67 per cent.

Marked improvement in both symptoms and basal metabolic rate was observed after administration of Lugol's solution in all the cases. Twenty-four patients were operated upon, and two died.

CHARLES D. ENFIELD, M.D.

Exophthalmic Goiter in Childhood. Henry F. Helmholz. Jour. Am. Med. Assn., July 17, 1926, p. 157.

Ulcers in gastro-intestinal tract.—The true etiology of melena neonatorum is not definitely known. The observation has long since been made that infants, dying from melena, frequently have duodenal ulcer: it has been estimated that ulcers some place in the gastro-intestinal tract occur in 45 per cent of such infants. Such ulcers may be very small—in fact, they may be very easily overlooked. The case reported by the author required detailed study before the ulceration near the pylorus was demonstrated. A number of investigators have demonstrated diplococci or streptococci in these ulcerations, and a certain degree of specificity of the organism is shown in the tendency of these organisms to localize in the gastro-intestinal tract, in animals into which they are injected.

Careful search will reveal peptic ulcer in a larger number of cases of melena neonatorum: in three cases studied, streptococci or diplococci were demonstrated in the tissue of the ulcers. It is believed that these must be the chief etiologic agents. Healing of duodenal ulcers begins very early and proceeds rapidly, so that, under proper conditions, the injury may be entirely repaired in a few days, an additional reason why they are so difficult to find. The rapidity of the healing of duodenal ulcer probably accounts for many of the recoveries from melena neonatorum.

L. R. SANTE, M.D.

Etiology and Healing Process of Duodenal Ulcer in Melena Neonatorum. Roger L. J. Kennedy. Am. Jour. Dis. Child., May, 1926, p. 631.

X-ray therapy of purpura hemorrhagica.—A severe case of purpura hemorrhagica which was temporarily benefited by splenectomy had a recurrence which responded very well to roentgen radiation. The lower extremities were exposed, through 6.0 aluminum, 12 × 12 cm. port of entry, 23 F.S.D., 2.5 H surface dose (12 per cent in 10 cm. depth). The effect is explained by the action of the roentgen rays on the circulating blood and the endothelium of the blood vessels rather than on the bone marrow.

E. A. POHLE, M.D.

Regarding the Roentgen-ray Therapy of Morbus Werlhof (Purpura Hemorrhagica). A. Grosglik. Strahlentherapie, 1926, XXII, 721.

Roentgen irradiation of brain tumors.—Several cases of inoperable brain tumors are reported, showing remarkable improvement after roentgen-ray treatment. Particular attention is called to the beneficial effect on the hydrocephalus internus and the improvement of chronic headache. Experiments carried out on dogs seemed to show that the choroidal plexus is sensitive to roentgen radiation; a pyknosis of its epithelium cell nuclei was observed. The mechanism of the effect is, therefore, seen in a secretion-inhibiting action of the rays. In cases of slight hydrocephalus internus, accompanied by headache, roentgen therapy is recommended. Technic: 1 front, 1 occiput, 1 left and right temporal field, 6 × 8 cm., 4–6 H on each field, through 0.5 zinc plus 3.0 aluminum; 25 cm. F.S.D., distributed over four to eight days and to be repeated two or three times at intervals of two months.

E. A. POHLE, M.D.

New Results in the Study of the Roentgen-ray Effect on Brain Tumors. M. Sgalitzer. Strahlentherapie, 1926, XXII, 701.

Foreign body.—The author thinks that the X-ray diagnosis and localization of a non-opaque foreign body lodged in the bronchus may now be made with almost the same degree of certainty as is the case with an opaque

foreign body. Repeated examinations will reveal all foreign bodies lodged in the trachea with the exception of a very small percentage; the few remaining cases can be diagnosed by physical signs, because the foreign bodies are of such a shape and size as to be freely movable in the trachea and they do not cause expiratory obstruction.

With opaque foreign bodies in the lung shadows are of comparatively little importance in diagnosis, but in detecting non-opaque foreign bodies the diagnosis may turn upon the interpretation of the shadows of every part of the lung field, as well as of the mediastinal structures, the diaphragm, and the chest wall. In dealing with a non-opaque foreign body exposures must be made during inspiration and expiration, and so rapidly that the motion of respiration may not blur the film. Non-opaque foreign bodies are almost always vegetable, such as nut kernels, seeds, maize, beans, shells, and roots. As a rule they produce more inflammatory reaction than metallic and other inorganic substances, and they may give rise to obstructive emphysema, atelectasis, "drowned lung," or lung abscess, either alone or in combination. When the foreign body is in a bronchus, X-rays will show increased transparency of the affected lung, depression and limitation of motion of the diaphragm on the affected side, and displacement of the heart and mediastinal structures to the unaffected side at expiration.

When the trachea is concerned the signs will be increased transparency of both lungs, depression and limitation of motion of both diaphragms, and rotation of the heart so that its transverse diameter is less at expiration than at inspiration.

In atelectasis the obstruction is more complete and the radiographic appearance is the opposite of that seen in obstructive emphysema.

In "drowned lung" the exudate appearing distally to the foreign body gradually fills the smaller bronchi and air vesicles, and adds density to the lung shadow. Remarkable variations may be seen at different observations in an individual case, and localization is based upon the area of the lung involved.

Non-opaque Foreign Bodies in the Air Passages. W. F. Manges. Brit. Jour. Radiol., April, 1926, p. 119. (Reprinted by permission from Brit. Med. Jour., July 10, 1926, p. 7 of Epitome of Current Medical Literature.)

Radium therapy.—Carcinoma must be considered as a grave menace to the human race: over 300,000 persons are suffering from it in the United States to-day, the death rate being 89.4 per 100,000. Whatever the cause, a definite period between the present time and its ultimate discovery must be bridged over. Surgery has reached its limits of perfection. The full value of irradiation, whether by radium or the X-rays, is still an open question, except that it is generally agreed that in advanced cases of carcinoma of the cervix irradiation is the method of choice.

The authors have adopted Schmitz's classification of the various stages of the disease and group them as follows:

"*Primary cases,* those receiving initial treatment from us, are divided into four classes. In Classes I and II the disease is macroscopically limited to the cervix; in Class III the disease has extended beyond the cervix either in the broad or uterosacral ligaments or vagina, including the borderline cases; in Class IV are the advanced cases with extensive involvement of the tissues of the pelvis or abdomen, the so-called 'frozen' pelvis.

"*Secondary cases* are those recurring after hysterectomy for cancer of the cervix."

A test dosage of 2,400 to 3,600 mg. hours of radium is given and the effect noted at the end of six to eight weeks. If complete regression has resulted, no further radiation is given unless subsequent examinations reveal further recurrence of the lesion. The authors feel that successful ultimate results can be secured even in individuals who do not at first respond, by repeated doses given at intervals—monthly examinations should be made to detect at once any recurrence. By this means the writers have secured 23.6 per cent of five-year cures in all carcinoma of cervix cases treated—52.9 per cent in Class I and II cases.

They summarize as follows:

"1. For purposes of comparative study a standardized simple classification of the extent of the disease, and the same rules of estimating end-results and percentages, should be adopted by all clinics.

"2. A monthly follow-up conducted in person by the surgeon in charge of the patient is of inestimable value as a factor in the successful treatment.

"3. The details of technic are important. Especially should over-radiation be avoided, and subsequent treatment should be based upon the reaction to the test dose of radium. This does not permit of employing repeated doses at short intervals, regardless of the response to the *first* dose of radium.

"4. In our experience repeated irradiations, three or more, have been of distinct value in certain advanced cases.

"5. By watchful waiting it is often possible to extinguish the fire that is rekindling, before it has gained much headway.

"6. According to our results radium alone is preferable to surgery in all classes of carcinoma of the cervix.

"7. As at least 50 per cent of the early cases of carcinoma of the cervix can be saved by radium, the importance of educating the laity and the family physician to seek an early diagnosis is imperative.

"8. While carcinoma of the fundus is best treated by surgery, many times the operative risk is poor and resort must be had to radium and roentgen-ray therapy.

"9. Large amounts of radium are not necessary to produce satisfactory results.

"10. The value of roentgen-ray therapy in carcinoma of the uterus is still an undetermined question.

"11. Every case of carcinoma of the uterus should be individualized and treated accordingly."

L. R. SANTE, M.D.

The Radium Treatment of Carcinoma Uteri. George Gray Ward and Lilian K. P. Farrar. Am. Jour. Obst. and Gynec., April, 1926, p. 439.

Diagnosis of pyloric stenosis in infants.—This subject is discussed in "Bedside Medicine for Bedside Doctors" by a number of physicians, all of whom believe that the diagnosis can be made without the use of the X-ray. They rely on the symptoms of loss of weight, projectile vomiting, dehydration, reverse peristalsis, and—sometimes—tumor. Some of them mention the X-ray as confirmatory of other evidence, and Dr. Cook believes it well to have films in every case, at least if a decision to operate is made. Films clarify the situation in the minds of the parents.

F. B. SHELDON, M.D.

The Symptoms and Evidence that Warrant a Diagnosis of Pyloric Stenosis in Infants. Alanson Weeks, Guy Cochran, J. C. Cummings, A. A. Bird, Mabel A. Geddes, J. H. Kuser, and Enos Paul Cook. Calif. and West. Med., July, 1926, p. 74.

Cardiac estimation.—A large number of observations were made on cardiac shadows, of normal individuals, taking into account sex, age, height and weight. The averages were computed and a formula derived for ascertaining the approximate normal maximum transverse diameter of the cardiac shadow. The authors present the following summary:

"1. New tables are presented for the estimation of normal transverse cardiac diameter in man. These tables are based on the following prediction formula: Transverse diameter in millimeters equals age 0.1094— stature 0.1941 + weight 0.8179 + the constant 95.8625.

"2. The tables given here introduce a means of prediction that is 19 per cent efficient.

"3. New variables that have but slight relation to age, height and weight, while paralleling transverse diameter rather closely, must be sought in order to improve this formula.

"4. If the heart is found to be 5 mm. wider in its greatest transverse diameter than the diameter as predicated by this formula, the chances are three to one that the widening is pathologic."

L. R. SANTE, M.D.

Estimation of Transverse Cardiac Diameter in Man. Fred J. Hodges and J. A. E. Eyster. Archiv. of Int. Med., May, 1926, p. 707.

Effect of roentgen rays on erythrocytes.—No agreement has been reached in the literature as to the effect of roentgen rays on the erythrocytes in normal and sick persons. The author carried out experiments on rabbits to study this problem. From one to twenty S.U.D. were given over the first and second lumbar vertebræ with the following technic: 180 K.V., 3 ma., 0.5 copper, 23 cm. F.S.D., 6 × 8 cm. field of entry. A definite increase in the number of red cells and in the hemoglobin was present in the majority of the treated animals. No histological difference could be demonstrated between the exposed and unexposed marrow during the first three or four days following the treatment. The erythrocytes showed no change in their resistance toward hypotonic salt solution; the water content of the serum was not decreased. From these findings, it is deduced that the observed increase is a so-called pseudo-increase and not due to a higher production of red cells in the marrow but to some changes of the circulatory factors in the periphery caused by substances arising from destroyed cells. Continued study of the marrow of the irradiated vertebræ revealed a decreased erythropoiesis; the marrow became finally insufficient for regeneration. These changes are not specific for roentgen rays; it seems sure, however, that radiation has only an injurious effect upon red blood corpuscles. Its therapeutic use in cases of pernicious anemia is, therefore, not advisable.

E. A. POHLE, M.D.

The Effect of Roentgen Rays on Red Blood Corpuscles. F. Kromeke. Strahlentherapie, 1926, XXII, 608.

Post-operative roentgen-ray treatment of breast carcinoma.—The question of post-operative irradiation of patients who have undergone a radical amputation of the breast was widely discussed at the last meeting of the German Roentgen Ray Society. Two well known therapists, Jüngling (Tübingen) and Holfelder (Frankfort-on-Main), presented the standpoint of their respective clinics (Perthes and Schmieden). Jüngling suggested a revision of the various stages of cancer of the breast as given by Steinthal and showed, with the aid of statistics of his own and other clinics, the results of post-operative X-ray therapy of breast cancer. It seems that high massive doses do harm; but, on the other hand, medium doses given over a long period may be of benefit.

A questionnaire sent to twenty-five German and Austrian clinics reveals the interesting result that ten do not treat at all after a radical breast amputation; ten carry it out as a routine; in five clinics, only selected cases are referred to the roentgenologist. As the result of his investigation, Jüngling stated that the post-operative irradiation of carcinoma of the breast had not yet passed the experimental stage; many years of careful study would be necessary to solve this problem.

Holfelder agreed almost entirely with Jüngling's viewpoint; he went a step farther, however, and demonstrated a technic which he had developed with the aid of his field selector. This method permitted the administration of a sufficient dose of roentgen energy to the breast without irradiating too much of the healthy tissue and of the lungs. It is a procedure which may be called tangential exposure. For details we must refer to the original, which is accompanied by very good illustrations. Holfelder as well as Jüngling emphasized the fact that each case must be considered individually, and no standard procedure should be carried out. Therefore, such treatments belong to institutions well equipped to measure their dose and enjoying full cooperation between surgeon and roentgenologist.

E. A. Pohle, M.D.

Is the Prophylactic Treatment of Breast Cancer Justified? O. Jüngling. Strahlentherapie, 1926, XXII, 653.

Is the Post-operative Treatment of the Breast Cancer Justified? H. Holfelder. Strahlentherapie, 1926, XXII, 667.

Tuberculous lymph nodes.—Tuberculosis of the mesenteric lymph nodes is found in children with great frequency. The condition is usually discovered at operation or autopsy and is rarely suspected or found by the clinician. A simple and effective means for the discovery of tuberculous lymph nodes, and one which is not used often enough, is roentgen-ray examination. Still points out that in his own experience 88.3 per cent of tuberculous children have tuberculosis in the abdomen. Preparation for X-ray examination consists of administration of mineral oil every evening for five successive nights, adding one grain of phenolphthalein on the last evening. Examination is made next morning on an empty stomach.

The shadows of calcified lymph nodes, as usually seen, are oval, rounded or crescentic. They appear white as contrasted with the shadows of the vertebral column, and are much more intense than the shadows cast by bone. It is a remarkable fact that the shadows of calcified nodes may stand out in detail when superimposed on the shadow of the much thicker vertebral column. The shadow of the calcified tuberculous node is not homogeneous, but exhibits variations in density, giving it an appearance which may be described variously as "mulberry-like," "honeycombed," "moth-eaten," "mottled," "spotted" or "coarsely stippled." The periphery usually casts a shell-like shadow which is more dense than the shadow of the part within, but it is not itself homogeneous, being more intense (more heavily spotted) in some parts than in others. In some cases, the central portions of calcified nodes cast scarcely any shadows at all. Under these circumstances, the peripheries appear as circles or crescents with perhaps but one or two pin-point spots representing the interior. The shadow of a tuberculous node forms a crescent when a part only of the outer portion is calcified.

L. R. Sante, M.D.

Tuberculosis of Abdominal Lymph Nodes: Diagnosis by Means of the Roentgen Ray. Ethel C. Dunham and Arnold M. Smythe. Am. Jour. Dis. Child., June, 1926, p. 815.

Symptoms of primary cancer of the lungs.—Primary cancer of the lungs is apparently increasing, both relatively and absolutely. The authors here report seventeen cases. The ages of the patients range from 32 to 77.

Pain was the earliest and most persistent symptom. Dyspnea, usually comparatively early, depended for its severity on extent of involvement, presence of fluid, and pain. Cough was usual. Weakness was outstanding. Weight loss occurred late, as did cachexia. Some fever was the rule, and anorexia was almost constant. Dullness was the most con-

stant early physical sign. A rather severe secondary anemia was the rule.

Detailed roentgen-ray findings are not given, but the importance of the roentgen-ray examination is stressed and the suggestion offered that it is apt to be the crucial factor in the diagnosis.

CHARLES D. ENFIELD, M.D.

Primary Cancer of the Lungs: A Clinical Report of Seventeen Cases. John A. Lichty, F. R. Wright, and E. A. Baumgartner. Jour. Am. Med. Assn., July 17, 1926, p. 144.

Chronic abscess.—The author records a case of chronic abscess in a patient, aged 24, who had received a kick on the lower end of the tibia some years previously. The pain lasted only a few hours and there was no bruising. Six months later there was an acute exacerbation of pain which compelled the patient to rest. Since that time there had been intervals of freedom from all trouble, alternating with attacks of pain. Radiograms taken at different times demonstrated no bony lesion. Two years later, when seen by Auvray, there was some swelling round the ankle, but the skin appeared normal. On palpation over the tibia there was a well marked spot of localized tenderness near the lower epiphysis; pressure here caused acute pain. The diagnosis was then made of a localized abscess of the bone, and this was confirmed by radiographic examination. At operation the bone was opened and a chronic abscess with thick pus was found in the lower end of the tibia. The pus was sterile and gave no growth on culture. The condition appeared to be a chronic osteomyelitis, probably originating from the kick. The patient had some boils at that time, and it is suggested that the infection may have arisen from this source.

Chronic Abscess of the Tibia. Auvray. Bull. et Mem. Soc. Nat. de Chir., March 20, 1926, p. 321. (Reprinted by permission from Brit. Med. Jour., June 19, 1926, p. 103 of Epitome of Current Medical Literature.)

Whooping cough.—The authors, who record eight cases in children aged from four months to eight years, state that the good results reported by Leonard and Bowditch in the treatment of whooping cough by X-rays induced them to employ this method in the Santa Cruz Hospital at Barcelona. They attribute the success obtained to the rapid transformation of lymphoid tissue into scar tissue, the paroxysms diminishing in intensity and disappearing within the first few days of treatment. The tracheobronchial glands, which undergo enlargement as the result of toxic inflammation, after vigorous irradiation show hyperplasia of their connective tissue, which on contraction causes diminution of its size and consequent disappearance of the principal source of irritation of the vagus and recurrent laryngeal nerve, which is the cause of the infective catarrh.

Whooping Cough Treated by X-rays. A. Pinos and J. M. Pujadas. Rev. med. de Barcelona, May, 1926, p. 447. (Reprinted by permission from Brit. Med. Jour., July 10, 1926, p. 7 of Epitome of Current Medical Literature.)

Novocaine and light erythema.—The injection of 1 per cent novocaine solution reduces the light erythema and pigmentation considerably. The experiments which were carried out on human skin with the mercury vapor lamp showed also that the injection after the exposure had no effect. Spectographic investigation proved that the assumption of a selective absorption by the novocaine was correct. Very interesting is the fact that the wave lengths from 3,130 to 2,540 Ångströms are absorbed, because at 2,970 Ångströms is the biologically most effective line.

In a brief preliminary communication, the author and his co-worker report the results of some investigations as to the nature of the substances in the skin which absorb the radiation around 2,970 Ångströms. They find that certain lipoids soluble in acetone seem to have this property; they absorb, in contrast to novocaine, rays shorter than 2,540 Ångströms.

E. A. POHLE, M.D.

Effect of Novocaine Injection on the Light Erythema. St. Rothman. Strahlentherapie, 1926, XXII, 729.

Regarding the Absorption of the Phlogogenous Ultra-violet in the Human Skin. W. Schultz and St. Rothman. Strahlentherapie, 1926, XXII, 736.

A new carbon arc lamp.—The author describes a new carbon arc lamp of his own design in which the carbons are parallel to each other; therefore, the total intensity radiates straight forward. Special impregnation assures the emission of ultra-violet rays down to 2,170 Ångströms. The major part of the energy is, however, in the red and infra-red. He claims that the spectrum of this lamp is most similar to that of the sun.

E. A. POHLE, M.D.

A Carbon Arc Lamp Based on New Principles. Albert E. Stein. Strahlentherapie, 1926, XXII, 751.

Protection in deep therapy.—The amount of scattered radiation in deep therapy treatment rooms when using a lead cylinder which encloses the tube is not to be overlooked. The author suggests the encircling of the patient with a cotton-lined lead strip which leaves only the field of entry open, and also the use of a leaded cone reaching from the port-hole in the tube drum to the patient.

E. A. POHLE, M.D.

Scattered Radiation in Treatment Rooms for Deep Therapy. H. Scheffers. Strahlentherapie, 1926, XXII, 726.

Laryngeal papillomata. — The authors state that laryngeal papillomata, though comparatively rare, may become malignant after the age of forty; the prognosis in childhood is also serious. Being situated on the vocal cords, the ventricular bands, and subglottic region, they produce severe dyspnea, and tracheotomy is usually required. Surgical treatment is commonly followed by relapse. The prognosis has been much improved since the introduction of X-ray treatment.

The authors describe the case of a youth, aged 17, who suffered from dyspnea and progressive aphonia. Tracheotomy was performed in 1920, and numerous operations for the prevention of asphyxia had been required before and since that date. When X-ray treatment was first employed, the vocal cords were almost completely hidden by cauliflower-like papillomata. During a period of four weeks the patient received a total dosage of 7,000 Behnken units, the treatments being applied alternately to each side of the neck. Deeply penetrating rays from a 40 cm. spark were used, filtered through 0.5 mm. copper and 2 mm. aluminium. A dose of 1,000 units was applied twice weekly. After the third treatment the tracheotomy tube was no longer required, and the papillomata were much smaller, and one month later the voice was almost normal. Six months subsequently the patient had remained quite cured. The larynx showed some scarring at the site of the papillomata, and there was some deformity of the left vocal cord. The tracheal fistula had closed spontaneously.

The authors refer to two previous patients, treated in 1920 and 1921, who have remained entirely cured. They state that X-ray treatment is preferable to any other in this disease.

X-ray Treatment of Laryngeal Papillomata. I. Solomon and A. Blondeau. Jour. de Radiol. et d'Electrol., March, 1926, p. 112. (Reprinted by permission from Brit. Med. Jour., July 10, 1926, p. 7 of Epitome of Current Medical Literature.)

Exstrophy of the bladder.—Authorities differ as to incidence of this condition, but agree upon its comparative rarity. It has been observed 95 times since 1901 at the Mayo Clinic. Fifty per cent of children born with this defect are dead by their tenth year, and 66.67 per cent do not live beyond the age of twenty. It is associated with spina bifida, hare lip, imperforate anus, epispadias, and other congenital structural defects. Death is usually due to nephritis. Surgical attempts to transplant the ureters into the intestines date from 1851, when Simon did the operation, whether successfully or not the authors do not state. Since that time various surgeons have undertaken to form bladders by plastic procedures. The operations of Maydl, Moynihan, and Coffey are described in some detail. The authors state that the most satisfactory operation for this condition, if the ureters are normal, is to unite the right ureter with the rectosigmoid and the left ureter with the upper sigmoid. The technic of this procedure is given in detail.

It is best to operate to correct exstrophy of the bladder between the ages of four and ten: the operation has been successfully performed upon older persons, but dilatation of the ureter is more common in these cases, and, if both ureters are dilated, it is inadvisable. To determine the condition of the ureters, it is sometimes advisable to inject them with sodium bromide and radiograph them. This furnishes information which may save unnecessary surgery, in case they are found to be greatly enlarged.

Statistics of the Mayo Clinic cases are given in full detail.

Exstrophy of the Bladder. Charles H. Mayo and William A. Hendricks. Surg., Gynec. and Obst., August, 1926, p. 129.

Discussions.[1]—The author makes an excellent presentation of his subject, treating it as follows: "The formation of the habit of clear thinking and the proper expression of one's thoughts while standing before an audience is well worth the effort and practice, however much it may require, to enable one to properly present the subject in mind. Nowhere is it more valuable as an asset than while discussing a subject which has already been presented in the form of an essay upon some scientific subject, or the relation of some investigation or experience, or perchance the presentation of a medical or surgical case to a medical society.

"It is not the good fortune of all men to have the native ability to acquire this faculty,

[1]Reprinted by permission from *California and Western Medicine*, June, 1926, p. 762.

or the proper training to enable them to acquit themselves with credit to themselves or to the subject which they wish to discuss. Yet there are few graduating in medicine at present who cannot overcome the handicap of lack of native talent, if they will but make a decided effort. . . . It is the duty of those who would receive the greatest benefit . . . from medical society meetings, that they fit themselves with the ability to take an intelligent and active part in discussions.

"The value of medical meetings to their members is in direct relation to the amount and value of the information presented in the papers read, their intelligent discussion, the making and renewal of acquaintances, and the social contacts. The intelligent discussion of a scientific paper presupposes an intimate acquaintance with one or more items covered by the member in his essay, and in order to be able to do this the program should be studied somewhat in advance, and the particular items desired for discussion selected and noted. Should the member desire to present a case *a propos* to the subject, he should have an abstract of the history, and he should review it well, that there may be no hesitancy or inaccuracy in the report; at the same time, it should be well boiled down that he may not overstep the time allotted for discussion. Accuracy and brevity in reporting histories can hardly be overestimated. Frequently these reports are abstracted and embodied in other reports, by other writers. In any case, should a discussant desire to comment on some one or more points of importance, of which he is not sure, he should look up authority on the subject that he may not get into deep water, so to speak, from some question handed him from the floor. . . .

"Another point we should bear in mind is to be sure to adhere closely to the subject under discussion. Many a member has wasted much valuable time by relating case histories which, before he has finished his discussion, are found perhaps remotely related to the subject, but not *a propos*. Yet when the member finally takes his seat, he does so with the apparent feeling that he has added much to the value of the meeting. Another item . . . is the habit some have of wandering entirely afield from the subject in hand, and if the chairman does not lasso them and bring them back—something no chairman likes to do—valuable time is wasted. Another habit some have is to feel called upon to discuss papers, whether they have any constructive information in mind or not. Some such are well informed, and what they say is pertinent, well presented and correct, but it may be common information, and few care to listen to matters with which they are perfectly familiar.

"I believe the thought must have occurred to most of us while listening to a member who has the floor with something on his mind of more or less importance—at least to himself—that he is laboring under such a serious handicap that an attempt to follow him requires a degree of mental concentration which few care to exercise. I have often thought that if some speakers could hear their own discussions exactly as they are delivered from a phonographic record, it would give them the surprise of their lives. This refers to one of the unfortunate, yet not uncommon, habits of hesitation, as though the speaker were having difficulty in formulating his ideas in speech, or possibly could not recall just what he wished to relate, or, peradventure, his mind was trying to work and take a vacation at the same time. We will say he is relating a case something as follows: 'He — a — had a — a — nasal discharge — a — for many years, a — and his nose — a — a — had been — a — operated on — a — many times. There — a — had been — a — periods — a — a — during the past — a — ten years — a — a — when — when he was — a — entirely free — a — from — from symptoms.' While attending a medical meeting not long since, a member took up the discussion of a subject upon which he appeared to be well informed, and if he could have related what he had in mind in a straightforward and connected manner, it would have been of value, and well worth listening to. It occurred to me soon after he began his remarks to count the times he repeated a certain interjection. I found that in the five minutes, more or less, he was speaking he repeated the '— a —' seventy-five to eighty times. It is not only the mental fatigue the audience must sustain, but the time wasted, and the meeting finds itself running behind its schedule.

. . . . . .

"Again, there is occasionally seen the member who seems possessed with the idea that in a multitude of words there is wisdom. Perchance the speaker may be a visitor from some other society—this has been noted—who out of courtesy is asked by the chairman to 'say a few words,' and this visitor takes advantage of circumstances to go the limit, so to speak. He appears to feel that as a guest of the society he is not likely to be limited as to time, and talk he does, and when at last he has finished, not one in twenty could give any satisfactory account of his discussion, but he has enjoyed himself immensely. This last criticism is a digression from the title of this address, for which I apologize. . . .

"It is not my purpose to present all of the 'don'ts' applicable to all kinds of abuse which an individual may inflict upon an audience of

scientific men, for there are many others which will occur to any regular attendant upon medical meetings. One may mention briefly the importance of the use of good Anglo-Saxon, which is far better than part English, some French, German, or Italian, which some appear to think they must use to show their superior culture, otherwise the audience might never know that they were learned in these languages. Some appear to forget, for the time at least, that they are members of a learned profession, and as such should use unadulterated English. All too frequently we listen to discussants who tell of 'getting by,' 'putting over,' and any number of like expressions current on the street, but not dignified language to be used in a convention of educated physicians.

"There are few occasions of more delightful interest to the average physician than to listen to a discussion by some one who has something in mind, the result of mature thought, and who speaks concisely in good, understandable English, in well rounded sentences, properly condensed, each complete in itself without embellishment. This discussant takes you with him wherever he goes; you listen to his remarks with unalloyed pleasure, and when he sits down you have the lesson he brought, and you are likely to take it home with you without the aid of a notebook."

The Discussion of Scientific Papers. William H. Dudley. Calif. and West. Med., June, 1926, p. 762.

Cancer statistics.—The author has tried to ascertain whether there is a real or only an apparent increase in cancer. He has reviewed statistically the cases of malignant disease found in a large hospital at Marseilles from 1870 to 1925. In the period 1871–1875 there were 11 cases of cancer for each 1,000 admissions, and in 1920–1924 there were 40 cases per 1,000. He groups the location of the disease into *old cases,* such as tongue, uterus, vagina and liver, which were recognized in the earlier period, and *new cases,* such as stomach and rectum, which are of more recent recognition. He finds the old cases show a decrease in the later years, while the new cases show a steady increase. This is really due to the fact that these cases are more readily diagnosed at the present time. Cancer is comparatively rare before thirty years of age, and frequent after fifty years; it occurs most frequently from fifty to sixty years of age. The increase of cancer cases is, then, partly due to the increased age to which people now live and the larger number of older people in the world. The better diagnosis at the present time has also to be considered. The author concludes that while there is a real increase in the number of cancer cases, this is actually due to the increased length of life.

The Increase in the Incidence of Cancer. L. Imbert. Bull. d'Assoc. Francaise pour l'Etude du Cancer. April, 1926, p. 141. (Reprinted by permission from Brit. Med. Jour., August 14, 1926, p. 22 of Epitome of Current Medical Literature.)

Chronic ulcerative colitis.—The authors define this disease condition as "that form of chronic ulceration which is not caused by infestation with parasites, tuberculosis, dysentery, actinomycosis or syphilis." They state that the differentiation from other forms of colitis is not always easy. They enumerate the diagnostic measures to be instituted as (1) a properly taken and correctly interpreted clinical history, (2) careful examination of the stools, (3) proctoscopy, and (4) roentgenologic examination.

"While this paper primarily considers the roentgenologic signs," yet the authors briefly review the other features that enter into the diagnosis. Their paper should be read in connection with Bargen's paper (Am. Jour. Roentgenol. and Rad. Ther., July, 1926, p. 10; abstracted elsewhere in this issue), which goes more exhaustively into the etiology.

The roentgenologic findings are explained by an understanding of the pathologic changes found in the wall of the large bowel, a description of which Hale White published in 1888. The authors favor the use of the barium enema in making examination of suspected cases; "the ingested meal merely shows rapid emptying, as in all conditions accompanied by diarrhea, without giving a satisfactory idea of the size or condition of the bowel."

They describe their method as follows: "For the enema a fairly fluid suspension of barium is used, and is injected slowly under roentgenographic control, careful search being made for any evidence of spasm, irregularities or encroachments on the lumen of the bowel. In fact, the behavior of the bowel as the column of barium ascends often gives the first evidence of the presence of a lesion. A sufficient amount is injected to fill the bowel, care being exercised not to over-distend it or cause undue discomfort."

The signs of the well-advanced case of colitis, of carcinoma, of syphilis, of tuberculosis, of actinomycosis, of parasitic infestation are told as only men who have made themselves masters of this division of roentgenog-

raphy can tell them. They summarize as follows: "It must be borne in mind that the roentgenologic examination furnishes but one link in the chain of evidence and must be used in collaboration with the clinical and proctoscopic findings. By this method the percentage of correct diagnoses may be made extremely high."

The Roentgenologic Findings in Ulcerative Colitis. Russell D. Carman and Alexander B. Moore. Am. Jour. Roentgenol. and Rad. Ther., July, 1926, p. 17.

Inflammatory disease of the colon.—The various names which have been borne by the disease condition denominated by the writer of this paper as chronic ulcerative colitis provide proof of divergent theories as to its etiology. He says that it is only since the use of the sigmoidoscope that the disease has been diagnosed in a living subject. The literature on the subject—dating back to its description by Wilks and Moxon in 1875—is reviewed in detail.

Statistics from the Mayo Clinic cover cases of patients from 3 to 73 years of age, though its greatest incidence seems to be in the second and third decades of life. Bargen enumerates the symptoms as follows: "Continuous or intermittent, intractable diarrhea, with bloody mucopurulent rectal discharges, general malaise, frequently pain and tenesmus, anemia, mild leukocytosis, occasional fever, and general wasting. The onset is usually insidious, although it may be sudden." Arthritis is a frequent complication, and malignancy is frequently superimposed on the colitis. To Buie is given credit for the best proctoscopic picture that exists of the ulcerative condition.

Experimental work, with accompanying photographs and photomicrographs, is described. There are reports of three clinical cases, with specific descriptions of the roentgen examinations of the colons.

The Etiology and Treatment of Chronic Ulcerative Colitis. J. Arnold Bargen. Am. Jour. Roentgenol. and Rad. Ther., July, 1926, p. 10.